THE

JOURNAL OF GAS LIGHTING,

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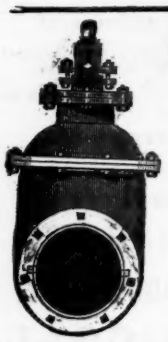

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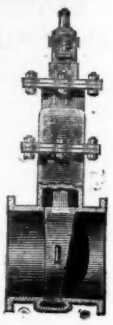

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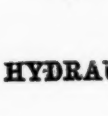

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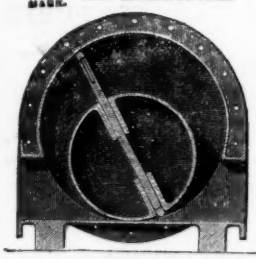

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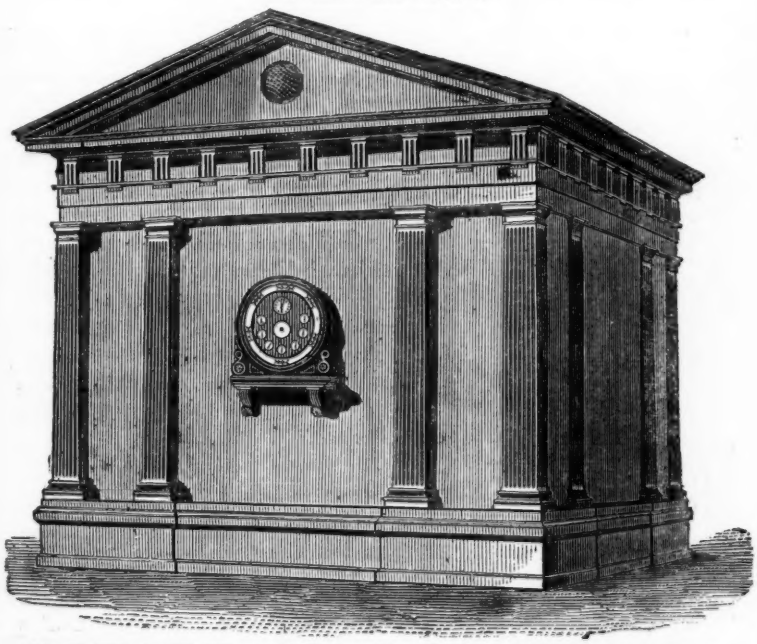

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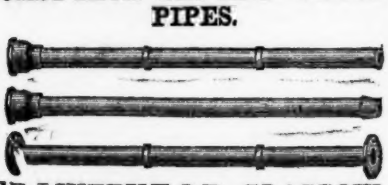
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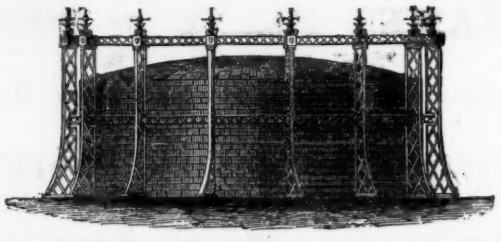
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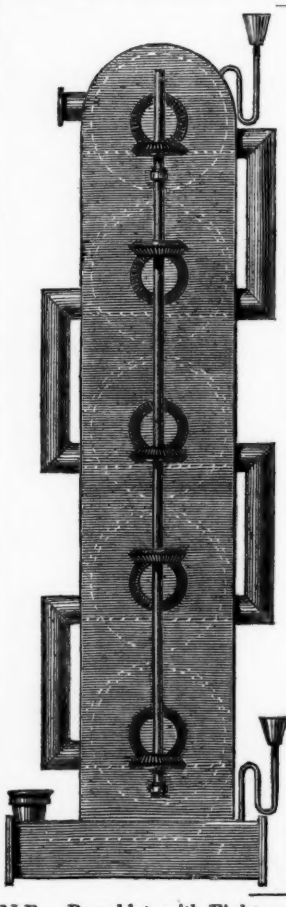
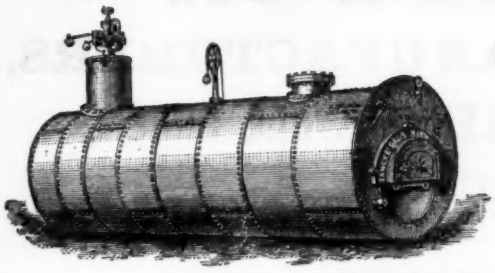
PATENT
COMBINED WASHER AND SCRUBBER.

TESTIMONY OF ITS ACTION.
The Gas-Works, St. Albans, April 27, 1877.
DEAR SIR,
Your Brush Scrubber has been in action here for four months.
It removes the whole of the ammonia from the gas, so that it will not discolour moistened turmeric paper.
The brushes cause no appreciable increase of pressure, and there is no repumping of liquor. Clear water run in at top, issues from the bottom fit to proceed to the sulphate-house.
It performs its work more efficiently than the tower scrubber I have, while only about half the height, and not one-fourth its weight or capacity.
My purifiers also last much longer before they are foul than they did previously.
I am, yours truly,
A. F. PHILLIPS.
G. Anderson, Esq.,
35*a*, Great George Street, S.W.

PATENTEE and MANUFACTURER of the following Inventions:—
RETORT SETTINGS—giving great Economy of Fuel.
STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES.
FUEL-MACHINE, for Compressing Breeze and Tar.
N.B.—Pamphlet, with Eighteen Illustrations and Letterpress on the Construction of Gas-Works, post free, 2s. 6d.
PRICES AND ALL PARTICULARS TO BE HAD OF THE PATENTEE,
35a, GREAT GEORGE STREET, WESTMINSTER, S.W.

STEAM-BOILERS,



CORNISH,

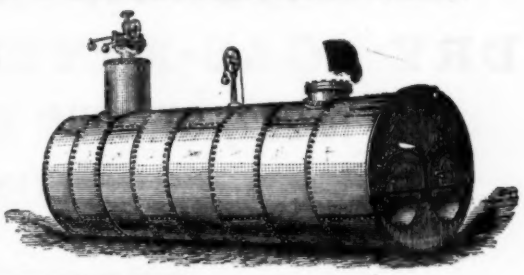
LANCASHIRE,

EGG-ENDED AND VERTICAL,

IN ALL SIZES,

AND OF

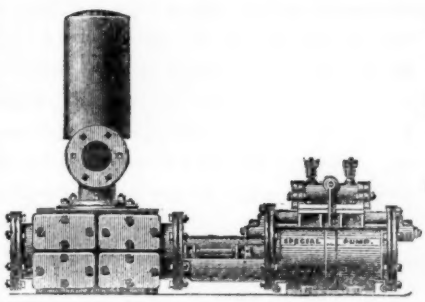
SUPERIOR QUALITY.



Prices on Application.

THE "SPECIAL" STEAM-PUMP.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1½	9	450	£16
4	2	9	815	18
5*	2½	12	1,250*	20
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



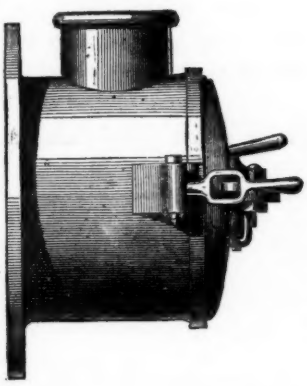
In use in 100 Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

Messrs. Burt, Boulton, and Haywood, Manufacturing Chemists, have over FORTY "Special" Steam-Pumps in use at their several large Tar-Works.

Several hundred "Special" Steam-Pumps are in successful operation, feeding Steam-Boilers.

200 Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

* These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.



MORTON'S

Patent Self-Sealing

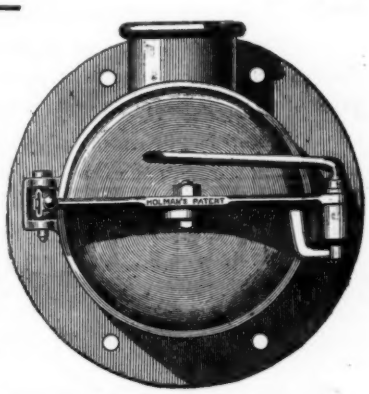
RETORT LIDS,

WITH

HOLMAN'S NEW PATENT BRACKETED CROSS-BARS, ANTI-FRICTION CATCHES, AND ECCENTRIC FASTENINGS.

Instantaneous Sealing effected. No Luting. No Duplicate Lids required. Holman's New Self-Sustaining Cross-Bar ensures freedom of joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested (rigid cast iron is now successfully employed), being now in use in nearly all the principal Gas-Works in London and the Provinces.



IMPORTANT TESTIMONIAL.

The Gaslight and Coke Company (commonly called the Chartered Gas Company), Beckton, North Woolwich.

Gentlemen,—In answer to your inquiry respecting the Self-Sealing Lids, I beg to say that they continue to work well, and I have every reason to be satisfied with them. I should be very sorry to return to the old system of Luting, and our stokers here freely acknowledge the benefit to them of the new system.

I am, yours truly, (Signed) G. C. TREWBY.

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

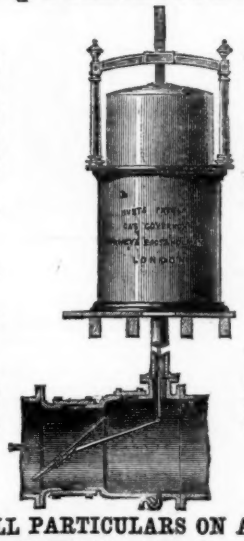
Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at any convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.



These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dronfield, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Sheffield, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,

(Signed) JOHN JOHNSON.

PRICES AND FULL PARTICULARS ON APPLICATION TO

TANGYE BROTHERS & HOLMAN,

SOLE MANUFACTURERS,

LAURENCE POUNTNEY LANE, LONDON, E.C.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

TO GAS ENGINEERS AND MANAGERS.

It having come to our knowledge that a report is in circulation, spread by some unprincipled person or persons, that the cases of our larger-sized Meters are made of Galvanized Iron, we think it only fair to ourselves, and just to our customers, to say, that we never have used, in making any of our Meters, a single pound of *Galvanized Iron*, or any other *cheap* and *inferior material*, and this can be easily seen by opening any of them.

The cases of our large-sized Meters, from 20 lights and upwards, are all made of the very *Best Best Patent Alloy*, which is nearly double the price, and will last more than double the time, of some other material that has been and still is very largely used for the same purpose. And our experience, acquired by an extensive use of it for upwards of 30 years, enables us to say with confidence that no other metal in use for the purpose is so little liable to corrosion from the action of the gas.

We have now in use a Meter made in 1848, and therefore 29 years old, the case of which is made of Patent Alloy; the Meter is still in perfect order, and shows no signs of decay.

The utmost care is exercised by us in selecting none but the very best materials for all parts of our Meters; much of it is made *expressly for us*, as it is not possible to obtain it in the open market of the same superior quality.

The great fall in the price of all materials used in making our Meters has enabled us to give an increased discount, thus giving our customers the benefit of the fall. This we were bound in fairness to do, as we raised the price of our Meters four years ago, when the price of all metals went up.

It will be our constant endeavour, by using none but the best materials, and employing the most skilful workmen, to maintain the high character our Meter has hitherto borne.

WILLIAM PARKINSON & CO.

(ESTABLISHED 1816)

ARE THE ONLY MAKERS

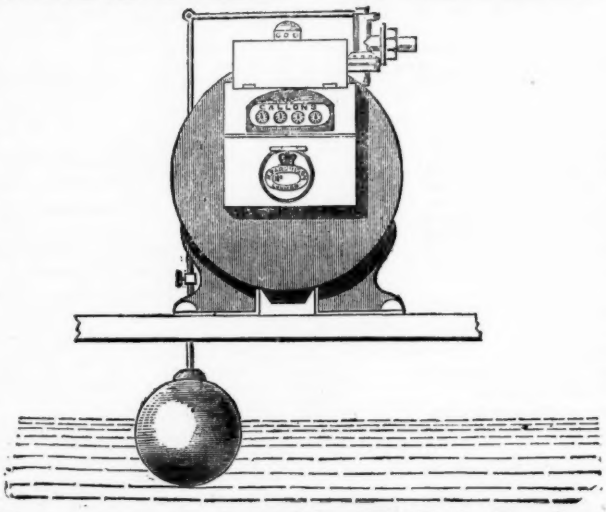
OF THE

LOW-PRESSURE WATER-METER.

These Meters will register with perfect accuracy, either at full speed, or with a few drops only passing through them.

They must be placed over the cistern to be supplied, and the water, after being measured, will fall from the outlet into the cistern below. Each Meter is fitted with a ball-valve, so made that it can be adjusted to shut off the supply at the inlet when the water reaches any required height in the cistern.

The 100-gallon Meter is fitted with a cistern holding about three or four gallons, and may be fixed inside a house, free from the effects of frost, and requires no attention after once being fixed.



From "The Engineer," April 6, 1877.

"Low-pressure Meters have been found to register with almost perfect accuracy, or, at all events, within 5 per cent. either for or against the consumer, and from the nature of their construction are by no means easily deranged. Still, even the low-pressure meters have their disadvantages, but these are chiefly as respects the question of first cost, seeing that they must have a cistern fixed at a higher level than that at which the supply is needed. All things considered, however, the balance of opinion rules at present in favour of the low-pressure Meter, and they are consequently increasing in favour as time goes on."

These Meters have been manufactured by W. P. & Co. for more than 25 years, and are largely used by the following and other Water Companies:—

NOTTINGHAM, DERBY, LEICESTER, SUNDERLAND, GREAT YARMOUTH, SHEFFIELD, NORWICH, LOWESTOFT, COVENTRY, SOUTHEND.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

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No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

AGNUS.—*The remuneration is in neither case excessive.*

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, AUGUST 7, 1877.

Circular to Gas Companies.

THE fears of those—and we believe they were numerous—shareholders in The Gaslight and Coke (Chartered) Company, who thought that the reduction in the price of gas made by the Directors at the beginning of the year would prove detrimental to their interests, will be effectually dissipated by the report and statement of accounts which will be presented at the half-yearly meeting on the 17th instant. We may remark at once that, under the circumstances, no more satisfactory document was ever issued by this prosperous Company; and then may make a short comparison of the accounts now presented, with those for the corresponding period of the previous year. To begin with revenue. The receipts for common gas during the past half year, all sold at 3s. 6d. per 1000 feet, amounted to £766,292. In the first half of 1876, with the greater bulk of gas sold at 3s. 9d.—only the small district of the late Independent Company being supplied at 3s. 6d.—the sum received for common gas was £783,048. The difference represents but an insignificant falling off in the receipts, and proves the soundness of the policy which led the Directors to make the reduction. The increase of business is seen in the amounts of coal carbonized and gas sold in the two half years. In the first half of 1876 the quantity of coal carbonized by the Company was 507,556 tons; in the half year just concluded they carbonized 529,783 tons, being an increase of 22,227 tons. The increased quantity of gas sold, of course, corresponds. In the first half of 1876 the Company sold 4,468,876 thousands of common gas; and in the past half year 4,655,263 thousands. It is curious to note that the cost of purification has been a few pounds less, although the charge for labour in connexion with this department has been increased by over a thousand pounds. The explanation is, of course, too evident to need mention. On turning to other items, we find less reason for satisfaction. The receipts for coke and also for tar are less than in the corresponding half of last year. That coke should have realized a smaller sum may be accounted for by the fact that coal has cost the Company much less. In the first half of 1876 they paid for coal £455,050; in the past half year they have only paid £437,094. Why tar should have realized less we do not know. On the other hand, ammoniacal liquor has brought over £2000 more than in the corresponding period of last year.

On the whole, then, the Directors are perfectly justified in taking a very cheerful view of the state of the Company's affairs. Notwithstanding the reduction of price to which we have alluded, they are able to pay full dividends out of current profits, and carry forward a balance of £24,813, which, added to the undivided profit of last year, makes up the sum of £68,239.

There can be no doubt that the profit of the present half year will considerably exceed that we have just mentioned. The policy upon which the Directors have entered is certain to lead to a large increase in the consumption of gas. Coal remaining cheap, and, possibly, though not probably, becoming cheaper, we may fairly anticipate that the shareholders will, in a year or two, reap one advantage of the sliding scale, and participate in an increased dividend justified by the reduction of price. As it is, the success exhibited in the report of the past half year's working will completely re-establish the confidence of the shareholders in the stability of their investments. There is, indeed, nothing to fear from any source but another coal famine. As regards the "electric candle," the Directors have caused a special investigation into the merits of the invention to be made, and they say, as the result, that they regard it with no apprehension. Its development as an illuminating agent for large spaces will, as we have said before, necessarily be slow. For private lighting we have at this moment no indication that it can ever be adapted. Thus gas must reign supreme for very many years to come; and all that is wanted to promote its use, and increase the prosperity of Gas Companies, is that they should make it as pure, and supply it as cheaply, as possible.

We are not certain that the "electric candle" has not rendered an essential service to one Gas Company—the Liverpool United. By the report which we publish in another column, it will be seen that the proposal of the Special Gas Committee of the Corporation of Liverpool to open negotiations for the transfer of the Company's undertaking to the Corporation, has practically fallen through. The Committee have been authorized to have an interview with the Directors to ask on what terms they would sell, but have not been empowered to treat for the purchase. There is no disguising the fact, that the Company are strongly represented in the Town Council; still, it will be seen that a good deal of use was made of the "electric candle" to frighten the Council from engaging in an enterprise which might presently be superseded. From two points of view, we regard the result with satisfaction. In the first place, we entirely deprecate the possession of purely commercial undertakings by Corporations; and then we regard the enormously increasing debts of Local Authorities with great apprehension. The Liverpool Company could never sell their undertaking for less than the price justified by past profits and a prospective increase. The purchase would land the Corporation in a debt, large even for Liverpool, and the eventual result could not be foreseen. It might be that the works, under Corporation management, would turn out a source of profit; it is quite as likely, as said by some members of the Council, that they would involve a loss. In any case there is the danger—distant, most undoubtedly, notwithstanding the announcement of M. Jablochkoff, that in three months he will have something startling to show—that gas may be superseded by some other illuminating agent. And what would the ratepayers of Liverpool then say? Altogether, we come to the conclusion that the Corporation are far better off without the gas-works. They have their hands, as Alderman Samuelson very correctly said, sufficiently full already, and their endeavours should be directed rather towards compelling the Company to fulfil their accepted contracts than to the acquisition of the undertaking, which might prove disastrous. The statutory profits of a Gas Company cannot be considered excessive, even to original shareholders. To those who have purchased shares at recent rates we consider the interest as meagre, notwithstanding the soundness of the security.

We do not expect that we have heard the last of the contest between the Longwood and the Colne Valley Gas Companies, another phase of which we report to-day. The legal point at issue has still to be decided, and a jury is not competent to settle it. The case, we anticipate, will again come under the notice of one of the Superior Courts, and then we shall probably learn

whether one Gas Company can break up the roads within the district of another without committing a nuisance. We express no opinion on this particular case but this—that if the verdict we report to-day be sustained, grave results to Gas Companies may follow.

We always look forward to the meetings of the Cambridge Gas Company with interest. The learned gentleman who so ably presides over the Company always takes advantage of these occasions to deliver addresses which are interesting, not only to the audience to whom he speaks, but to every gas shareholder, and, indeed, to the general public. In the admirable speech he delivered yesterday week, for example, he described at some length, and in a popular manner, the advantages of using gas for cooking purposes. This portion of his address deserves to be reprinted and circulated by every Gas Company. True, it has all been said before; but never, we venture to say, so well said, nor with the authority that Dr. Phelps commands. Of course, the "electric candle" came in for some notice, and on this matter the opinion of Dr. Phelps is of importance. A profoundly scientific man himself, he, necessarily, from his position, comes in contact with some of the first physicists in the world. We may guess that he has discussed with Professor Stokes the possible application of electricity as a substitute for gas, and, therefore, when he tells us that there is no reason to believe that electricity can ever compete with gas, even in street lighting, we accept the assurance with great satisfaction. For the rest, we are certain that all our readers will peruse with much pleasure this last speech of the learned Chairman of the Cambridge Company, for which, unfortunately, we have not space this week.

The report of a sort of indignation meeting held at Hampton Wick, to protest against an alleged nuisance at the gas-works, once more draws from us the remark that gas-works need not, and ought not to be sources of offence. Some smell must inevitably emanate from them, and there are everywhere fastidious people who will make complaint. But, allowing for exaggeration—we do not say untruth—on the part of some speakers at the Hampton Wick meeting, we feel bound to believe that there is a real grievance which is capable of being easily remedied. If the manufacture of sulphate of ammonia is carried on, as we suspect is the case, the sulphuretted hydrogen need not be allowed to escape into the air. Any competent engineer can devise a plan for conducting it to a furnace, where it will be converted into a comparatively inodorous and perfectly harmless compound.

Water and Sanitary Notes.

The Town Council of Manchester, at a recent meeting, resolved unanimously to promote a Bill in the next session of Parliament to sanction the scheme for obtaining a supply of water from Thirlmere. We have reason to believe that the scheme will not be allowed to pass unchallenged, even in Manchester itself, and a strong opposition may be expected elsewhere. Thus, we are certain to witness a most important contest, which will occupy a Select Committee, or possibly two, for a considerable time. There is, no doubt, water enough in the Cumberland and Westmoreland lakes to furnish a supply for half England; still it excites jealousy that any one of them should be appropriated by one particular city. We must wait to see what practical form the opposition will assume; but it would seem certain that it will be serious.

The whole of the district of the Wimbledon Local Board is within the limits of the Lambeth Water-Works Company; but we gather that the Water Company do not furnish a supply throughout the parish. Under these circumstances, the Wimbledon Board have devised a scheme for giving a supply independent of the Company; but, doubtful of their power to do so under the Public Health Act, they have consulted with the Local Government Board, and from the Assistant-Secretary of the Central Authority they have obtained a reply which may be of interest to all Water Companies. He says: "I am "instructed to state that if the limits of the Local Board are "within the district of the Lambeth Water Company, the Local "Board could not commence works of water supply until they "had given notice to the Company, as required by section 52 of "the Public Health Act. The Local Board are precluded by "that section from constructing water-works under the Act "named, if the Company are able and willing to supply "water, proper and sufficient for all reasonable pur-"poses for which it may be required, and any ques-"tion as to the quality and sufficiency of the supply must "be referred to arbitration." This is, of course, a plain statement of the law as it stands, and, coming from an official, it will carry weight. The case is somewhat different where a non-statutory Company are concerned; but even in such a case no works could be commenced without the sanction of the Local Government Board, and we take it as certain that no expenditure would be allowed if it were proved on inquiry that the Company in possession were able and willing to furnish that proper and sufficient supply which the Public Health Act seeks to make obligatory. Here is an authoritative opinion as to the meaning of the Public Health Act, and at the same time a clear intimation to Water Companies as to the means by which they may safely confront the opposition of Local Authorities. The Act may be said to require a proper and sufficient supply for all reasonable purposes. That being furnished, the Company are safe in the possession of their property. We must, however, continue to recommend all Companies to seek statutory protection, either by Provisional Order or Special Act.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CXLI.

Valves.

A valve is a device or contrivance for permitting the flow of water, steam, gas, or other fluid, through simple orifices, or through pipes and other conduits, and stopping the same at will.

They are of many different forms, but in the present division of the "Treatise" we shall confine ourselves to a description of the two kinds commonly used in connexion with gas mains and services—viz., the hydraulic valve and the slide valve.

The hydraulic valve has the merit of being more durable and less costly than the slide, and it is certain in its action so long as the water-lute is in order, and the column of water of sufficient depth to counterbalance the pressure exerted upon it. It is not generally so handy of application as the slide, and therefore is principally confined to the pipes on the gas-works, such as the inlet and outlet pipes to the holders, &c., for which it is exceedingly suitable.

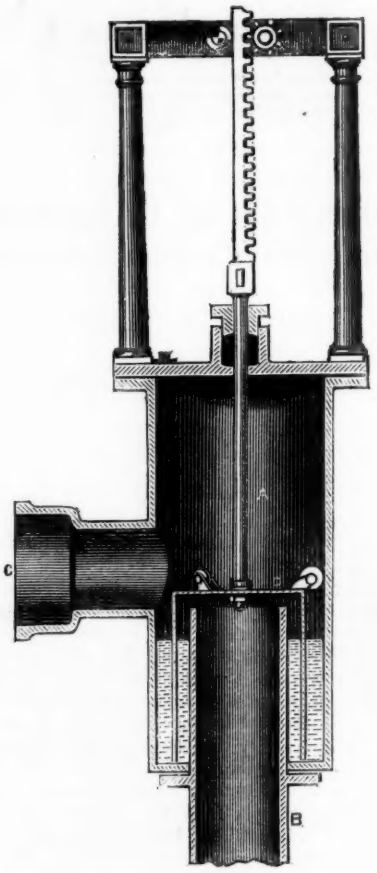


Fig. 1.

Fig. 1 is a sectional view of one form of the hydraulic valve. A is an air-tight cylinder of cast iron, having at its lower part an annular cup formed by the insertion of the end of the inlet-pipe, B, and is nearly filled with water or tar; C is the outlet-pipe, and may be connected to the mains either by a socket or flange; D is an inverted cup of cast iron, 16 inches deep, to the crown of which a rod is secured by a nut; the other end of the rod passes through a stuffing-box in the cylinder-lid, and is attached by a cotter to a rack actuated by a pinion, working on a stud on the framework, as shown, for raising and lowering the cup. The latter is represented as resting on the cylinder bottom, and dipping into the liquid, in which position the

valve is closed, all communication between the inlet and outlet being shut off by the intervening column of water 12 inches high. On the cup being raised to the upper part of the vessel, a passage for the gas through the valve is established.

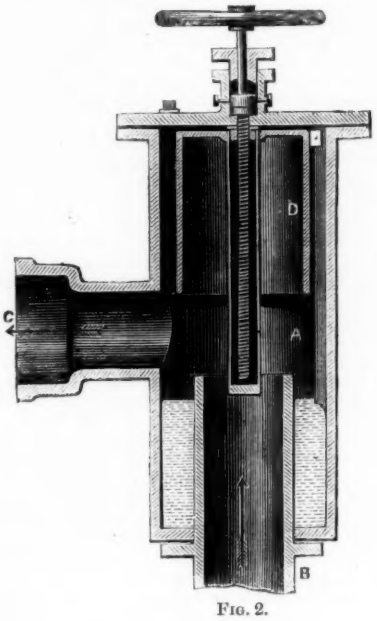


FIG. 2.

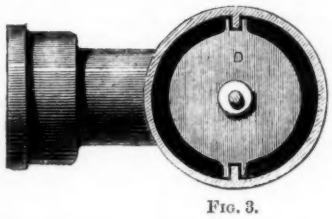


FIG. 3.

Fig. 2 is an arrangement of the same valve, differing from the foregoing only in the method of raising and lowering the cup. In this instance the cup slides upon the screw, which is turned by the hand-wheel. To prevent leakage through the screw-way, a piece of pipe the length of the screw, and plugged at its lower end, is attached to the cup, with which it rises and falls. Two guide-rails extend from the bottom to the top of the vessel, and fit into notches in the cup sides, as shown in fig. 3, to prevent the latter from turning round when the screw is worked.

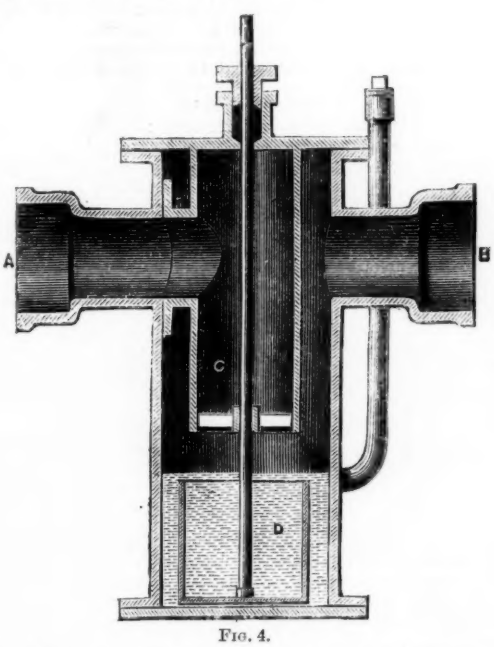


FIG. 4.

Another form of hydraulic valve is represented in the engraving, fig. 4. In this instance the cup, D, rests in the water or tar at the bottom of the vessel when the passage is open, and when this is required to be closed, it is raised by means of the rod so as to envelope the end of the central pipe, C. A is the inlet branch, and B is the outlet. A wrought-iron pipe is shown at the side; this is for the purpose of attaching a pump to draw off the surplus water that might accumulate and seal the passage.

(To be continued.)

CONTRIBUTIONS TO THE THEORY OF LUMINOUS FLAMES.

By Dr. KARL HEUMANN.

[Translated from the *Journal für Gasbeleuchtung.*]

PART II.

(Continued from page 172.)

My theoretical conclusions had carried me thus far when I saw the dissertation of M. Vogel on the increase of illuminating power by heating the gas, and the diametrically opposite conclusions arrived at by the London Gas Referees.

M. Vogel passed the gas through a U-tube, which was immersed successively in ice, a refrigerating mixture, boiling water, and heated paraffin. A steatite burner was fixed immediately on the exit end of the U-tube, so that the gas was burned as it issued. The photometric observations, taking the intensity of the light at + 18° as 100, yielded at 0° 76 and 85; at − 20° only 33 and 44; at + 100°, 104; and at + 160°, 118. This would show the influence of a low temperature to be very considerable, while heating yielded a result which, though not unimportant in itself, was by no means in proportion to the other.

These results were completely contradicted by the report of the Gas Referees, according to which no difference could be observed in the illuminating power of gas at 0° and at 145°. As far as I know, Vogel has made no reply to this, and, unfortunately, circumstances prevent me at present from repeating his experiments; but the following remarks on the question generally may assist in elucidating it.

With respect to the practical part of Vogel's experiments, it can scarcely be assumed that the gas issuing from the burner necessarily possessed the given temperatures of 0°, − 20°, 100°, and 160°, for, considering the exceedingly feeble heat-conducting power of gases, the passage through a single U-tube of a given temperature would certainly not suffice to raise the whole of the gas to the same temperature. A spiral tube, with many convolutions, would be decidedly preferable, and even then it would be desirable to adopt the precaution of inserting a small thermometer in the tube, at the end next to the burner.

In the photometric observations carried out by me with a view to the present remarks, the necessity of keeping an exact record of the gas consumption soon became apparent. I think I may, *à priori*, assume that the quantities of gas actually consumed in a unit of time, with a cooled or a heated U-tube, in Vogel's experiments, were not quite identical, and that the resultant figures would perhaps have been somewhat different if the difference in the gas consumption had been duly allowed for. However, Vogel's general conclusion as to the influence of the temperature of gas on its illuminating power would not be materially affected by this proposed alteration—probably, indeed, a still greater divergence would be observed in the figures. It is, therefore, a matter for further examination, whether the conclusion of the Gas Referees, that the illuminating power is equal, whether the gas possess the temperature of 0° or 145°, can possibly be founded on facts.

Unfortunately, the reports accessible to me of those experiments do not contain the details of their manipulation, so that it is impossible for me to decide whether they were carried out with proper care and judgment. So much, however, appears to me clear, that in considering the diminution of the intensity of the light by refrigeration of the gas below its ordinary temperature, the composition of the gas itself is of the most vital importance, and that Vogel's experiments can only be effectually verified by employing a gas of the same composition. It is quite possible that two descriptions of coal gas, which at 18°, with equal consumption, show the same intensity of light, would at 0°, or − 20°, differ very considerably, one losing much, the other but little of its intensity. A gas owing its brilliancy chiefly to a large proportion of ethyl would, even at a low temperature, emit much light, while a gas whose illuminating power depended chiefly on the presence of benzole and similar vapours, must experience a considerable diminution of light by refrigeration. One may say, therefore, that when Vogel observed a considerable diminution of brilliancy by refrigeration, while the Gas Referees quite contradict this, it only proves that the latter used a gas very poor in condensable hydrocarbons. On the other hand, in the increase of brilliancy by heating the gas, observed by Vogel, any influence of the composition of the gas is not so evident or certain, for that a fresh formation of more condensed hydrocarbons should take place as quickly as at 100° or 160°, is somewhat doubtful. On the other hand, every increase of heat must, of course, increase the brilliancy of the flame, so that Vogel's results may, to a certain extent, be anticipated as self-evident; and yet the report of the Gas Referees asserts that no increase of brilliancy took place.

My theoretical deductions given above were to the effect that, if the heat-depriving influence of the burner and of the issuing stream of gas could be diminished or eliminated altogether, the brilliancy of the flame would be considerably increased; but the report of the Referees contradicts this also. The only supposition that will reconcile these flat contradictions appears to me to be that the whole of the experiments deal with far too minute differences of temperature. Our photometric instruments are anything but perfect, and it would be really surprising if increasing the heat of a flame, already possessing a temperature of, perhaps, 2000°, by 100° or 145°,

should have the effect of producing an increase of brilliancy in any way appreciable by our photometers. Therefore, I was in no way disheartened by the negative results of the Referees, as only a very great increase of the heat of the gas could be expected to have any considerable influence in augmenting the brilliancy of the light, and I was at once induced to employ glowing heat, causing the gas to escape through a red-hot burner.

It has already been shown that the heat-abstracting influence of the burner might be neutralized by heating it sufficiently, and that the gas-jet would necessarily be heated at the same time. While, therefore, it is, on the one hand, impossible for a glowing-hot gas-jet to issue from a cold burner without at the same time heating the latter, and, on the other hand, equally impossible to use an incandescent burner without the temperature of the issuing gas being raised, the experiment of passing the gas through an incandescent burner yields a result equal to the sum of the two separate effects, of which neither can be estimated individually.

The experiments had to be carried out with several precautions, if the results were to be regarded as proving anything; and after it had been qualitatively demonstrated that the heating of the burner-tube produced a considerable increase of brilliancy in the light, it required to be carefully examined whether the consumption of gas experienced any alterations when the burner-tube was heated to incandescence. I have already stated that Blochmann has shown that the considerably decreased consumption of gas, when the jet is lighted, depends upon the heating of the burner-head, and it was to be expected that a red-hot burner-tube, being longer, would also occasion a diminished gas consumption. I had, therefore, constantly to take exact note of the quantity of gas consumed at the time I determined the intensity of the light. It appeared, however, that the diminution of the gas consumption with wide tubes, and, what is of greater importance, with a wide orifice, is not considerable. My experiments were carried out by causing the gas to pass through a meter, of which the indicator reading per minute gave the consumption in litres per hour. From the meter the gas flowed into a glass tube, inclined upwards in a slanting direction, over the upper end of which a tube, formed of platinum foil rolled together, was luted on air-tight. The powerful flame of a Bunsen burner was brought underneath the platinum tube, and when not in use was pushed aside, but not extinguished, so as not to alter the pressure of the gas. The readings of the gas consumed by the flame under examination, and the arrangement of the photometer, took place with the precautions already enumerated.

After the measurement and register of consumption had been taken with a cold burner, and then with an incandescent burner, the latter was allowed to cool and again experimented with, and the results only allowed to be trustworthy if the last one coincided with the first. Of course, during the whole series of observations, the position of the taps, of the burner-tube, &c., remained quite unaltered.

Two platinum tubes, of 10 centimètres in length, were used, the narrowest 4 millimètres, and the widest 8 millimètres in diameter. By means of the Bunsen lamp placed below, the platinum tube was heated near the open end, in such a manner that the platinum became incandescent to the extremity, but without causing any flickering of the flame under examination. The light emitted by the glowing platinum tubes was ascertained, by direct experiment without the gas-jet, to be so insignificant that it might be disregarded.

In the following table, columns 1 and 2 give the intensity of the light, measured in stearine candles, from the cold and the heated burner-tube, while 3 and 4 give the corresponding consumption of gas in litres. Column 5 shows the observed increase of light, and column 6 the simultaneous decrease of gas consumed, both calculated in per centages. To obtain comparable values for the actual gain in brilliancy, it was necessary to refer this latter element in both cases to an equal consumption of gas.

Although the relations between the brilliancy of the light and the quantity of gas consumed are not yet thoroughly understood (for the researches of Silliman, Pole, Hunt, and others on this subject do not at all agree together), I think I am justified in assuming a direct proportion for the small differences of gas consumption which occur in the following table, so that where 16 litres are observed to yield 0·4 candle light, a consumption of 15·5 litres may be calculated as yielding 0·38 light. Any possible error will be less than the possible error of observation. The figures thus arrived at by calculation are noted in column 7, while in column 8 the results in column 2 are repeated for easier comparison. Thus, for instance, a consumption of 15·5 litres of gas per hour, burned from a platinum tube 4 millimètres in diameter, yielded a light of 0·38 candle against 0·6 candle, when the tube was heated to incandescence. The gain in light per cent. is shown in column 9, and is, for the present example, 57·9 per cent.

		Light Expressed in Candles.		Consumption of Gas in Litres.		Increase of Light per Cent.	Decrease of Gas Consumption per Cent.	Degree of Light for the Decreased Gas Consumption.		Gain in Light per Cent.
		Cold Burner.	Hot Burner.	Cold Burner.	Hot Burner.			Cold Burner.*	Hot Burner.†	
		1.	2.	3.	4.	5.	6.	7.	8.	9.
Narrow tube.	I.	0·4	0·6	16	15·5	50·0	3·1	0·38	0·6	57·9
	II.	2·1	2·9	38	37·5	38·1	1·3	2·0	2·9	45·0
	III.	5·6	6·1	83	82·0	8·9	1·2	5·5	6·1	10·9
Wide tube.	IV.	0·8	1·5	23	23·0	87·5	—	0·8	1·5	87·5
	V.	2·0	2·7	41	41·0	35·0	—	2·0	2·7	35·0
	VI.	4·9	7·6	123	121·0	55·1	1·6	4·8	7·6	58·3

* Calculated. † Observed, per column 4.

The results of this table may be easily reviewed if curves are constructed from the figures in columns 1 and 3, 2 and 4, as has been already explained. For a very accurate curve, further determinations would be requisite, but for the object before us the above figures are quite sufficient.

In the first place, a considerable increase of light is perceptible in every case when the burner is heated to incandescence; then a glance at column 9 of Experiments I., II., and III. shows that the gain in intensity of light is much greater in a small flame than when more gas is consumed. The cause of this, besides the relatively smaller disilluminating effect of the burner in large flames (which is removed by heating), is clearly this, that with increased consumption in the same time a large quantity of gas passes the heated tube, and, owing to the greater velocity, is so much the less heated as this velocity of escape is greater.

The figures obtained from the wide platinum tube, however, show adeviation from this result, inasmuch as, with a greatly increased consumption of gas, the effect of the heated burner is also much greater. This, at first sight, unexpected result I explain as follows:—As is seen from Experiments V. and VI., with such a wide orifice, the gas is unfavourably situated for the development of light; thus, 123 litres of gas from a wide aperture only gave 4·9 candles, while 83 litres from the narrow tube gave 5·6 candle light. Obviously, the surface of the flame compared with its volume is much too small to permit of such energetic combustion that the interior of the flame can attain a sufficiently high temperature; but as gas, capable of developing light, is present in abundance, increase of the flame temperature, by heating the burner-tube, will produce a great increase of light (as 87·5 per cent. in Experiment IV.).

This effect must, as has been said, diminish with increased rapidity of efflux, and this is confirmed by Experiment V.; but as, with a still larger efflux, the flame becomes flickering, and deposits soot, the intensity of the light does not increase in nearly the same ratio as at first with the increased consumption, but falls off more and more till it remains stationary, and with still greater rapidity of efflux the intensity of light actually diminishes, reaching at last, as Benevides demonstrated, zero; that is, with very great rapidity of the gas stream, the flame becomes blue.

Although the advantage of the heated burner * decreases with increased consumption of gas, the intensity of the light from a cold burner diminishes in a much higher ratio with increased gas consumption; and it necessarily follows that the relative advantage of the hot burner will again increase from a certain point. When a curve is drawn, this fact is expressed by the curve of the flame, from the heated burner at first, with small consumption, advancing far beyond the other in the direction of increased intensity; the two curves then approach each other (at about 40 to 45 litres consumption), and again diverge, the flame from the cold burner remaining considerably behind the other.

With respect to the effect of heating the tube upon the quantity of gas consumed, the Experiments I., II., and III. show, as might be expected, a diminished consumption. With a narrow tube the expansion of the gas causes a greater obstruction to the efflux than with a wide tube, and for the same reason no diminution of the gas consumption was observed in Experiments IV. and V., the retarding action not becoming appreciable until the rapidity of 123 litres per hour was reached.

It would, therefore, appear to be proved that by heating considerably the issuing gas and the burner, a great increase of light is attained, and that the absence of such a result in the experiments of the Gas Referees is owing to the difference of temperature employed by them not being sufficiently great to become apparent in the photometer.

(To be continued.)

* I suspect, however, that the intensity of light from a wide aperture will have a second maximum point, as the rapid stream will draw more air into the flame, thus causing more active combustion. But this will depend greatly on the burner.

Death of Mr. Joseph Shaw.—We regret to announce the death of Mr. Joseph Shaw, of Guildford, which took place on Saturday, the 28th ult. Mr. Shaw was in the 67th year of his age, and had been for many years manager of the Guildford Gas-Works.

A Liberal Employer.—On the 14th of July, the clerks, assistants, and workmen in the employ of Messrs. Hulett and Co., Holborn, accompanied by Mr. Hulett and several friends, started by train for Brighton, in order to celebrate their annual feast, at the "Old Ship Hotel," the proprietor having an excellent spread in readiness, to which they did ample justice. After dinner, Mr. Hulett, in the course of an address to the *employés*, called forth several of the oldest hands in the service of the firm, and presented each with a valuable silver lever watch, having a suitable inscription engraved on the inside of the case, testifying to the good conduct and attention to business, and stating the number of years of service of the recipient. This kind act was quite unexpected, and will, no doubt, tend to cement that good understanding between employer and employed so necessary for the prosperity of both.

Weardale and Shildon Water Company.—The report of the directors of this company for the past half year has been published. The revenue account, including the amount brought forward from last year, shows an available balance of £5068 3s. 10d., out of which the directors recommend a dividend on the various classes of shares at the rate of 4 per cent. per annum, payable on the 10th inst., which will absorb £4693 6s. 8d., and the balance of £374 is carried to next account. It is stated that during the past half year the works at Tunstall have made considerable progress, notwithstanding the wet and unfavourable weather of the early part of the year. The embankment is now within 30 feet of the summit, and the masonry works are also in a very advanced state. Considerable extensions of supply have been made, especially towards West Carnforth and in the Dearness Valley. The Beechburn Service Reservoir is expected to be completed in the autumn, and the Mount Pleasant Reservoir before the close of the year. The statement of accounts shows that £35,609 have been expended on capital account during the half year.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

AUTOMATIC LAMP LIGHTING.

Sir,—Since listening to the interesting paper on this subject read by Mr. A. F. Wilson, at the meeting of the British Association of Gas Managers at Bristol, last month, I have paid some attention to the matter, and investigated the merits of the mechanical contrivance designed to raise from its present low level the operation of lighting our lamps in the streets, squares, and roadways of towns and cities; and the result of my examination has been the establishment in my mind of a strong conviction that, after all previous failures, success will crown the efforts, and may be fairly expected to reward the ingenuity, of the inventor of this highly ingenious instrument.

The practical difficulties hitherto standing in the way, and preventing the adoption of any automatic contrivance to put an end to the perambulations of the human lamp-lighter, have now been, as I believe, entirely overcome.

Fogs have been (metaphorically) seen through; and the objection existing in all such cases, where some portion, or portions, only of the entire number of the lamps in a town are required to be extinguished at a certain hour of the night, and the remainder at, say, sunrise, has been overcome in the simplest and easiest possible way. And in like manner every conceivable difficulty has been removed by persevering ingenuity; so that to-day the invention stands before the gas world in the satisfactory position of a proved success, available as a means of increased economy alike to gas companies and local authorities, besides effecting, in an admirable and efficient manner, the instantaneous lighting and extinguishing of every public lamp in a town at the agreed times.

The saving effected, consists of the lamplighters wages, which means the cost of a personal visit of a man to every lamp night and morning, and, in addition a visit, in some cases, to a part or portion of the entire number in the middle of the night, leaving nothing but the cleaning and repairing, and periodical inspection, to be done by personal application—and these expenses are common to the present and the proposed new system—and the further great saving in the quantity of gas now consumed wastefully, by the necessity of commencing to light about an hour sooner and extinguish an hour later than need be by the new method—long sought for and wanted—of instantaneous lighting and extinguishing.

I have looked into the matter, and thus expressed my ideas respecting it as a simple act of justice to the parties concerned, not having the slightest pecuniary interest in it as a commercial affair, nor in any other way whatever, and may state that, when I saw the contrivance for the first time at the Bristol meeting, I had neither time nor opportunity for carefully weighing its chances of successful action under the varying circumstances of every-day rough-and-ready work, and I have since felt that my indecision at the moment of summing up the discussion might be construed prejudicially to the interests of those who have furnished the funds required for the development of the invention; hence I have felt bound to examine it and express my opinion upon it, and shall take the earliest opportunity of testing its merits upon an extended scale.

R. P. Spice.

21, *Parliament Street, Westminster, S.W., July* 26, 1877.

NAPHTHALINE.

Sir,—You have doubtless already heard of my process for arresting naphthaline. This process is patented in England, and it consists simply in drying the gas, after its complete purification in the purifiers, with quick lime, or any other material capable of absorbing water. Naphthaline is no longer deposited after the gas has been thus dried. The lime is easily hydrated, and when it can no longer be used for arresting naphthaline, it serves very well for ordinary purification by lime, for the manufacture of the Laming material, or for the distillation of ammoniacal liquor for the manufacture of alkali or sulphate of ammonia.

By the drying of the gas an augmentation of from 6 to 8 per cent. in illuminating power is obtained. This is proved in the "First Report of the Gas Referees on the Construction of Gas-Burners with Reference to the Principles of Gas Illumination" (London, June 22, 1871), in the paragraph, "The Effects of Distance from the Gas-Works upon the Illuminating Power." That is an additional advantage of my process—no naphthaline; lime which, after its hydration, is useful for all the other purposes of gas-works; lastly, an augmentation of from 6 to 8 per cent. in illuminating power. I think these are advantages sufficient to generalize the employment of my process.

As soon as it is printed, I will send you my paper, presented to the *Société Technique de l'Industrie du Gaz en France*, and which obtained the prize of 250 francs. In it my experiments are described.

Versailles, July 30, 1877. L. Bremond.

[On receiving the paper above alluded to, we shall take an early opportunity of presenting a translation to our readers.—Ed. J. G. L.]

STEAM-JET EXHAUSTERS.

Sir,—I wish some abler pen than mine had been forthcoming to take up the cudgels in answer to Mr. Cleland's letter on the above subject, in your issue of the 24th ult.; but that his criticisms therein may not pass altogether unchallenged, I beg the favour of a space in your columns for the following reply.

Mr. Cleland's letter professes to show the fallacy of some of Mr. Paterson's arguments in his paper on the steam-jet, read before the British Association of Gas Managers at Bristol, and to prove, from figures extracted from that paper, that the slow-speed condenser possesses an advantage of 52 per cent. over the ordinary horizontal condenser employed by Mr. Paterson on the outlet of his jet exhauster. With this view, he takes the average surfaces required to reduce the temperature one degree in the horizontal condenser and in the slow-speed condenser, both of which were ascertained experimentally by Mr. Paterson, and calculates what should have been the result in the latter case, *other circumstances being supposed equal* (the italics are mine), due allowance being made for the smaller temperature difference on the inlet of the slow-speed condenser.

But the other circumstances are by no means equal, and herein lies the fallacy, in my opinion, of Mr. Cleland's argument, inasmuch as he ignores (1) the reduction of volume by temperature, and (2) the presence of the steam in the horizontal condenser. The first of these is easily disposed of. I apprehend the make of gas given in Mr. Paterson's tables was taken at the station-meter, and may be assumed to have a temperature of 60°. Now, every 1000 feet so measured would correspond to 1084 cubic feet at the inlet of the slow-speed condenser, where the temperature was 103°, or to 1163 cubic feet at the outlet of the jet exhauster, where the temperature was 143°. This is about 7¼ per cent. in excess of the quantity entering the slow-speed condenser, yet Mr. Cleland places this to the credit of the latter.

The presence of the steam on the outlet of the jet exhauster means a great deal more than appears at first sight, inasmuch as this not only causes a still further increase of bulk, but also contains an amount of latent heat that it requires considerable condensation to remove. Let us compare the work thrown upon the two condensers respectively, by estimating the mechanical energy employed in each case, premising, of course, that those energies are equal to what would be required to do the work that the condensers have to undo—that is to say, that the cooling effected in the condensers is equal to the heating the products would require to bring them again to the state in which they left the exhauster.

The horizontal condenser has to cool, say, 1163 cubic feet of gas from 143° to 103°—*i.e.*, through 40° Fahr. It has also to remove the latent heat of nearly 2 gallons (say 20 lbs.) of steam, in addition to the tar and liquor produced under ordinary circumstances. Taking as our unit the heat required to raise 1 lb. of water through 1° Fahr., one unit of heat = 772 lbs. Now the work required to cool 1163 cubic feet through 40° Fahr. being the same as that required to raise 1084 feet through the same amount, and the weight of the latter being, say, 35 lbs., and the specific heat of coal gas, when compared with an equal weight of water, being, say, ·59 [the specific heat of marsh gas; see Watts's "Dictionary of Chemistry," vol. iii., p. 35] the quantity of heat that will raise 35 lbs. of gas through 40°, will only raise 35 × ·59 = 20·65 lbs. of water through the same temperature, and the mechanical energy required to do this = 20·65 × 40 × 772 = 637,672 foot-pounds.

With regard to the latent heat, Professor Tyndall tells us ["Heat as a Mode of Motion," fourth edition, p. 144] that the heat required to convert a pound of water at 212° Fahr. into steam would be sufficient to raise 967 times that weight of water one degree, and the mechanical energy required to raise one pound of water through one degree being 772 foot-pounds, we have 967 × 772 = 746,524 foot-pounds as the latent heat of one pound of steam at 212°. Multiplying this by 20, we have 14,930,480 foot-pounds as the total power required to convert 20 lbs. of steam into water. As a matter of fact, it would be somewhat higher than this, as the temperature under consideration is only 143°, instead of 212°; but I have no tables at hand giving the precise figures. In Watts's "Dictionary of Chemistry" [vol. iii., p. 97] we have a table of latent heats at different temperatures, but which gives nothing between 50° and 100° Cent. Professor Rankine ["Steam Engine," third edition, p. 565] gives the latent heat of a pound of steam at 212° Fahr. = 745,812, and that at 140° = 784,795 foot-pounds, from which the difference could be approximately ascertained; but the above energy of, say, 15 million foot-pounds is sufficient for my purpose.

We have then a total energy of 14,930,480 + 637,672 = 15,568,152 foot-pounds to be effected by a horizontal condenser of 1311 feet superficial, or 11,875 foot-founds per foot superficial. Now, let us see what is required of the slow-speed condenser. Here we are met at once by the fact that the gas, travelling through 336 feet of 14-inch pipe, loses by far the greater portion of the condensed steam, which, at Cheltenham, is run off to the liquor-well in the ordinary manner, so that, although the gas at the inlet of the slow-speed condenser has a temperature of 103°, it must not be taken for granted that it contains anything like a proportional quantity of the steam containing the latent heat due to that temperature. I have reason to believe that from 1 to 1½ gallons of condensed steam is thus removed before reaching the slow-speed condenser, and the remainder, of course, has its latent heat considerably reduced before arriving at that point. The mechanical energy required to cool 1084 cubic feet from 103° to 72°, estimated in the same manner as in the case of the horizontal condenser, would be 571,938 foot-pounds for the slow-speed condenser of 1230 feet superficial, or 465 foot-pounds per foot superficial. Of course, it does more than this; but it is impossible to divide the latent heat so as to apportion to each condenser its proper share of condensation in this respect. I think, however, I have shown (1) that the actual cooling of the gas forms but a small part of the total work to be done by the condensers on the outlet of a jet exhauster; and (2) that by far the greater portion of the work in this particular case cannot possibly be left to the slow-speed condenser. If I have succeeded in establishing these points, I would ask, What becomes of Mr. Cleland's 52 per cent. in favour of the slow-speed condenser?

I do not wish to be understood to maintain for a moment that the slow-speed condenser has no merits. On the contrary, I consider the comparative rest given to the gas in its onward passage a most valuable means of throwing down liquid particles of any kind, whether of tar, or liquor, or condensed steam. But it is not on this ground that Mr. Cleland advocates its use; it is, firstly, the reduced resistance to the gas, and, secondly, the increased facility for radiation that he claims in its favour. That he is right on both points I will not dispute; but what do they amount to? Resistance is never very great in ordinary condensers, and his currents of air travelling up the pipes will not make very much difference to the effective power of his condensers.

Steam-Jet.

Broadstairs Water-Works Company.—The annual general meeting of this company was held on Tuesday, the 31st ult. The accounts showed a balance of £757 11s. 4d., and a dividend for the half year at the rate of 5 per cent. per annum was declared. The directors reported the completion of extensive additions to the works, and stated that there was now an ample supply of water of excellent quality.

Parliamentary Intelligence.

HOUSE OF LORDS.

TUESDAY, JULY 31, 1877.

AUCTION CLAUSES IN GAS BILLS.

On the motion of Earl REDESDALE, it was resolved—"That in every Bill by which an existing gas company is authorized to raise additional capital, provision shall be made for the offer of such capital, in shares or stock to be paid up within a limited period, by public auction or tender at the best price which can be obtained;" and it was ordered that the said resolution be declared a Standing Order, and that it be entered on the roll of Standing Orders.

THURSDAY, AUG. 2.

The following Bills received the Royal Assent by commission:—Ashton-under-Lyne Gas; Bolton Improvement; Bridgwater Corporation Water; Carnforth District Water; Carshalton Gas; Christchurch Gas; Coatbridge Gas; Colne Gas; Croydon Commercial Gas; Dukinfield and Denton Local Boards of Health; East Worcestershire Water; Epsom and Ewell Gas; Glasgow Corporation Water; Heywood Water; Leeds Improvement; Leicester Gas; Londonderry Gas; Lowestoft Water, Gas, and Market; Newcastle-under-Lyme Borough Extension and Improvement; North Cheshire Water; Perth Water; Reservoirs; Southend Gas; Stretford Gas; Sunningdale District Water; Thanet Gas; Wakefield Gas; Wakefield Improvement; Waterford Gas; Woolwich, Plumstead, and Charlton Consumers Gas.

HOUSE OF COMMONS.

MONDAY, JULY 30, 1877.

The Lords amendments to the following Bills were agreed to:—Ashton-under-Lyne Gas; Bolton Improvement; Dukinfield and Denton Local Boards of Health; Epsom and Ewell Gas; Wakefield Improvement.

On the motion of Sir ARTHUR GUINNESS, a return was ordered of costs incurred by the Corporation of Dublin in promoting, opposing, or watching the progress of private Bills, from 1872 to 1877 (in continuation of Parliamentary Paper No. 133, of session 1873).

TUESDAY, JULY 31.

The Lords amendments to the Bishop Auckland District Gas Bill were agreed to.

WEDNESDAY, AUG. 1.

PUBLIC HEALTH ACT (1875) AMENDMENT BILL.

The order for the second reading of this Bill was discharged, and the Bill withdrawn.

THURSDAY, AUG. 2.

The Lords amendments to the Burslem Local Board and Louth Gas Bills were agreed to.

THE PUBLIC HEALTH (IRELAND) BILL.

This Bill was reported from the Select Committee, with minutes of proceedings.

PUBLIC HEALTH ACT (1875) AMENDMENT BILL.

Mr. ALEXANDER BROWN gave notice that early next session he would introduce a Bill to amend the Public Health Act, 1875.

SPECIAL REPORT OF THE SELECT COMMITTEE ON STANDING ORDERS.

The Select Committee on Standing Orders have agreed to the following special report:—

"The committee are of opinion that, in any case where in future the estimate of any undertaking is increased during the passage of a Bill through Parliament, such increase should be made upon petition for additional provision."

HOUSE OF COMMONS COMMITTEE.

MONDAY, APRIL 30.

(*Before Mr.* SANDFORD, *Chairman; Mr.* LAMBERT, *Mr.* HANBURY, *Sir* HUGH CHOLMELEY, *and Mr.* A. BONHAM-CARTER, *Referee.*)

HANLEY CORPORATION GAS BILL.

(*Continued from page* 178.)

Mr. RICHARDS called upon Mr. Jeune to produce the accounts of the British Gaslight Company, notice of which had been served upon that company.

Mr. JEUNE submitted that the British Gaslight Company supplied several places with gas, and they ought not to be called on to produce accounts with respect to any other place than Hanley.

The CHAIRMAN intimated the acquiescence of the committee in that view, and

Mr. JEUNE stated that those who represented the British Gaslight Company would be ready to give any explanation that was required.

Col. *William Sargent Roden*, examined by Mr. RICHARDS.

I am an ironmaster at Hanley, deputy-lieutenant and a justice of the peace for the county of Stafford, and also a justice of the peace for the county of Monmouth. I have recently ceased to reside at Hanley, having lived there 20 years. I was a member of the corporation up to 1876, when my connexion therewith ceased. I was twice Mayor of Hanley, and was formerly a Member of Parliament for Stoke-upon-Trent. The gas question has been agitated at Hanley for many years. I am tolerably familiar with the feelings and wishes of the people of Hanley, and believe almost all the ratepayers are in favour of the works of the British Gaslight Company being in the hands of the corporation. I have been managing director of the Shelton Bar Iron Company, who employ more than 1000 hands, and at whose works gas is used extensively. Frequently during the past few years complaints have been made both as to the quality and quantity of the gas. I judged of the quality of the gas by the form of the flame. I also used gas at my late residence, where I had a large billiard-room. The gaslight was very insufficient, and during the last ten years many complaints were made. The meter I used was supplied by the company, who knew how many lights I had, and if there was any deficiency in the size of that meter it was no fault of mine. Most certainly I am in favour of the gas-works being in the hands of the corporation, who have always conducted their affairs in a liberal and public-spirited way. Markets have been established and managed very successfully; and public baths have also been established. I have every confidence in the competency of the Hanley Town Council managing the gas-works successfully; and I believe the ratepayers of the borough are not in the slightest fear as to any loss being experienced as a consequence of the corporation having them.

Cross-examined by Mr. MICHAEL: One of the advantages which I think would accrue from the corporation having the supply would be that they would have a more perfect control over the gas-works. I do not see how directors living in London can manage the affairs so well as people on the spot. The corporation would certainly trust to a qualified engineer whom they would place over the works, but at the same time they would look to it themselves, and see that the manager did his duty. I have never measured the gas nor tried it by a photometer; but the reason I was obliged to complain was that it was of a bad colour—it was not white. I had my fittings examined to see if there was any defect in them. I cannot speak as to the last year, because I have left the district. I think it is very possible the corporation might make a profit out of the gas-works, but it would depend upon the price they gave for them. I believe the corporation would have to repay the purchase-money in about 30 years, but I have not made the calculation. I would not advocate compulsory purchase at less than the undertaking was worth. I think it would be a very good purchase guaranteeing the company 10 per cent. upon their original capital, and the corporation to make the gas. I have not made any calculation as to the cost of coal, or anything of that kind.

Mr. MICHAEL: Taking the amount of purchase-money which you think ought to be given, and working that out by your sinking-fund—paying it by instalments extending over 30 years, together with interest, what is the advantage which will accrue to the corporation?

Witness: I consider that the law gives them the power to test the gas, and so on, and practically it is not properly done.

You go away from the question of finance to the question of purity. Can you give me anything in the way of finance?—I cannot give you any detailed particulars about the matter.

Will you tell me why the corporation should be able, in their management, to ensure greater purity and higher illuminating power than the company, who are obliged to submit to certain tests which the general Acts have provided?—The advantage, I think, would be that they would be able to manage it better—being on the ground—than a board of directors sitting in London.

Re-examined by Mr. RICHARDS: I have always understood that where corporations have taken gas-works into their own hands they have been successful speculations, and I think the Hanley Corporation might do the same.

The CHAIRMAN: Did you ever make any complaint to the magistrates of the quantity and quality of the gas?

Witness: No; the magistrates have no control over it.

Mr. *John Moulds*, examined by Mr. RICHARDS.

I am chief bailiff of the town of Tunstall, and chairman of the local board. In 1871 the population of Tunstall was between 13,000 and 14,000, and is supposed to be upwards of 15,000 at present. Including two neighbouring villages, I should put the population at 20,000. The British Gaslight Company supply Tunstall and those two neighbouring villages from their works at Brownhills. The Local Board of Tunstall are seeking to have clauses inserted in the present Bill to empower them to take their portion of the supply into their own hands. There has not been a public meeting, but the board are unanimous on the point, and our impression is that public feeling is in favour of the purchase of the undertaking by the Corporation of Hanley. We also approve of the terms, so far as we know of them. Our aim is ultimately to buy the Brownhills works, but we are in favour of the Local Board supplying Tunstall instead of the British Gaslight Company. We should manage the works by a committee of the local board, which would be an unpaid committee instead of a paid directorate, by which system we think there would be an advantage. The members of the board are elected by the constituency, who would have a direct influence, because it would be under their eyes, and they would be able to check any undue extravagance. At Tunstall we are favourably situated as regards coal, and we should have an opportunity of making our own contracts.

Cross-examined by Mr. JEUNE: If I signed a petition adverse to the Hanley Corporation acquiring this undertaking—although I do not recollect the circumstances—it was because we wished to have some modification in the Bill, and we took steps to place ourselves in a position to get them.

The CHAIRMAN: They were against having their gas supplied by the Corporation of Hanley, but now they have an understanding that Tunstall shall have its own gas-works, they withdraw their opposition. They do not say anything in favour of the management of your gas-works.

Mr. JEUNE: But they deny that the corporation can do it any better. (To witness:) At any rate, in your petition you deny that "the manufacture and supply of gas within Hanley and the neighbourhood can be conducted with greater efficiency and economy by the corporation of that borough than by the company." Is that your present view?

Witness: The Hanley Corporation say that they would save the large expenditure of a directorate; but we do not wish to be in their hands, if we could have our part of the works ourselves.

The CHAIRMAN: We may take it for granted that these gentlemen think they would rather have the supply in the hands of the company than in those of the corporation, but that, on the other hand, they would rather have it in their own charge than in that of either of the other parties.

Re-examined by Mr. MICHAEL: I do not know who prepared the petition which I signed.

Mr. RICHARDS: Should you be surprised to hear it was Mr. Michael who prepared that petition for you?

Witness: I do not think my solicitor gave me that information. The Hanley Corporation have met us fairly by saying they have no wish to supply out of their own district.

The CHAIRMAN: Has Tunstall made any complaint against the quality or quantity of the gas supplied by the present company?

Witness: Occasionally we have had cause to complain, but we have not taken any steps before the magistrates in consequence.

Mr. *Thomas Hulme*, examined by Mr. RICHARDS.

I am chief bailiff of Burslem, and chairman of the local board of health. The population of Burslem is about 27,000. Up to the present time the gas supply has been from the Burslem and Tunstall Gas Company, who purchased from the British Gaslight Company the mains and right of supply. The Burslem Company have carried on a very successful business, and paid the full maximum dividends. There was also a reserve-fund, which has been divided amongst the shareholders. In the present year, the Local Board of Burslem made an agreement to take the works into their own hands, and a Bill is now being promoted in Parliament to have the arrangement sanctioned. The arrangement was made with the consent of the gas company, and £80,000 was agreed to be paid for the works. The board had done that in the full belief that the result would prove a profitable undertaking for the town. The shareholders are chiefly residents in the locality, and have a direct interest in the prosperity and well-being of Burslem. I am quite in favour of local boards and town councils having the supply of gas in their own hands. I am aware that the Hanley Corporation offered to pay the full maximum dividend upon the invested capital of the shareholders; and consider it a very liberal offer. In the arrangement as to the transfer at Burslem, there was no opposition by the gas company. I decidedly think the Corporation of Hanley might safely be trusted with the management of the gas-works.

Cross-examined by Mr. JEUNE: I think the reserve-fund of the Burslem Company amounted to between £3000 and £4000, but I do not know when it was commenced. The company had also expended a large amount of their surplus money in improving the works, rebuilding, and so on, but no particular sums were laid aside for those purposes. The capital of the company was £36,000, on £8000 of which they paid 10 per cent.; on £15,000, 7½ per cent.; and on £13,000, 7 per cent., amounting in all to

£2835. They have no power to increase their capital beyond £36,000, but they can borrow money.

Mr. JEUNE: The local board paid more than 30 years purchase upon the dividend paid to the shareholders.

Witness: Yes, but the sum the board agreed to pay for the works was calculated upon the balance, which was £3500 odd. I think that is a fair way to calculate what should be paid for the works, and time has shown we were right in our calculations.

When you said the offer made by the Hanley Corporation was a liberal one, had you calculated what it was that was to be paid, and what it was to be paid for?—I say that if they have not made their statutory dividend they ought to have done so, but I have not gone into the figures.

Mr. *Edwin James Hammersley*, examined by Mr. RICHARDS.

I am an accountant at Hanley, and for five years have been a member of the corporation. Soon after I took my seat on the council my attention was called to the complaints made respecting the gas supply, both as to the illuminating power and the quality of the gas supplied to the public lamps and to private consumers. Shortly after my appointment Alderman Ridgway (chairman of the Works and Lighting Committee) and myself waited upon Mr. Haswell, the local manager of the gas-works, who substantially admitted that the complaints were justified, but explained that they arose chiefly from the negligence of the workmen, some of whom were not altogether steady. For some little time there was improvement, but complaints continued down to 1874, when strong remonstrances were made to the company by the town council, in consequence of there having been for some eight or ten days a prevalence of sulphuretted hydrogen. Northwood, a rather populous district, was very insufficiently supplied with gas at that time. In April, 1875, negotiations were opened with a view to the purchase of the gas-works, because we felt it was absolutely necessary that we should take the supply into our own hands. I consider that the corporation would be able efficiently to manage the gas-works, and that, instead of the interests of the ratepayers being imperilled, they would be benefited in various ways. The powers of the commissioners who were antecedent to the corporation were transferred to the town council at the time of the incorporation, but those powers were limited to the supply of the public lamps, and not to private consumption. I have compared the accounts of the British Company with those of neighbouring gas companies, and quite confirm the statements made that in every other town of the Potteries district the gas-works have been managed uniformly with success; but the British Gaslight Company do not appear to have paid their maximum dividend for some years. I have prepared a comparative statement showing the results of the gas undertakings in the Staffordshire Potteries for eleven years ending 1876, and I find some startling discrepancies between the managements. Taking the initial price of coal, I find the British Gaslight Company had spent £87,276 in coals, and a further sum of £3576 in purifying material. The produce of gas, residuals, and other matters, amounted to £220,737. Each £1 worth of coals only produced £2·529, or, including the purification, £2·428, while in Burslem every £1 spent in coals and purification produced a net result of £3·348; in Longton, £3·812; and in Stoke, taking nine years, £4·136; so that every £1 spent in Burslem produced £·920 more than was produced in Hanley; in Longton, £1·283 more; and in Stoke, £1·708 more. If the Burslem management had been applied to the Hanley works, and it had been necessary to have spent £90,000 in coals and purification, it would have resulted in an excess of profit over Hanley, in eleven years, amounting to £80,293; in the case of Longton the excess would have been £111,975; and in the case of Stoke, £149,067. As regards the actual loss to Hanley, as compared with the other stations, supposing the Hanley income could only have been £221,000, according to the Burslem management it would only have been necessary to have spent £65,917 in coals, so that the actual loss on that single item of coals and purification has been £24,935 in eleven years, or an average of £2266 a year. According to the Longton management, it would have been necessary to spend £57,829, showing a loss of £29,324, or £2671 a year. Taking the Stoke Company, with an initial expenditure of £53,362, the actual loss on the Hanley management is £37,490, or £3408 a year.

Mr. RICHARDS: Do you, therefore, found upon that a strong argument to show that Hanley has not been successful in the management of its works?

Witness: If there had been a local directorate, or if there had been a management by the corporation, instead of by a directorate in London, the Hanley consumers would have had this concern at the present moment, as compared with the lowest of these three places, standing at £25,000 to the good, instead of being, as they now are, £1000 to the bad. I believe the success of the Stoke Company has been due to the fact that they have had local directors, who, when there was a coal panic, or anything of that kind, were able to make contracts in a very few hours, whereas no one at Hanley had that power. I should say, with the fact before us of the success of the other towns, that the suggestion in the British Company's petition that their "management was successful" is poking fun a little at the corporation. "Want of success" would have been more correct. While negotiations were going on, the corporation had occasion to ask for an interview with the directors, and it was understood they would pay an early visit to Hanley, but after waiting a long time, we received a communication from the secretary to the effect that the constitution of the company did not admit of more than a single director visiting a station at a time. Judging from that letter that the mountain would not come to Mahomet, Mahomet had to go to the mountain, and a deputation from the town council therefore waited upon the directors in London in October, when the matter was discussed at considerable length, and our attention was directed to one or two points in the constitution of the company, particularly the section which did not permit the company to sell without the consent of Parliament, and we understood from that we should be obliged, under any circumstances, to promote a Bill. We were told that the company would be unwilling sellers, and I remarked that we did not care about that so that they were sellers, but that we should be glad to purchase because the public had evidently set their mind upon the matter. Amongst other things they pointed out a difficulty with regard to Tunstall—viz., that the council had not contemplated taking over any other works than those of Hanley, and then we suggested to them that we should buy the lot, as we had no doubt we could arrange with the Tunstall authorities to take over their portion. The directors further stated that, if we gave three times the value of the works, they would sell, but I do not know what they meant. If they meant three times the value of the paid-up capital, I do not think there is much difference between us. A suggestion was made that we might pay them their statutory dividends, having in our minds the terms upon which the Birmingham Corporation bought the gas undertakings in 1875; but then we thought, as they had not been—according to their published accounts—paying their statutory dividends, that they would be in immediate receipt of the full amount they could, by their Act, claim at the present time. From the year 1858 down to 1876 the company have taken from revenue a sum amounting to £17,880, which they call depreciation. That sum we cannot thoroughly trace (and that is why we desired to inspect the books), except that it has gone in extensions—that is on capital account. Supposing it had been treated as balance of profit and loss, and divided, the company would have received their full parliamentary dividend, and have had £7000 besides.

Mr. RICHARDS: Supposing the company paid 10 per cent. and 7½ per cent., the Hanley Corporation would be able to borrow money at a much lower rate of interest?

Witness: Yes; we could borrow money at 4 per cent. readily. We are not wedded to the statutory dividends. If the company require a lump sum we should be prepared to pay it on fair and reasonable terms. There is also an item in the accounts for "professional charges and incidentals," which, in my judgment, show very serious amounts, and which the corporation could do without, or, at any rate, a great deal of it. During the eleven years from 1866 to 1876, those charges amounted to £8158.

In the year 1871 those charges were returned at £312, while in the year 1876 they were returned at £1131. In 1872 that item was £443; in 1873, £454; in 1874, £466; and in 1875, £759. I know of nothing connected with Hanley that can at all account for those charges.

In the accounts for 1866 the expended capital is stated to be £48,109, but in 1867 the same item appears as £49,092?—Yes. That amount is brought forward wrongly; I cannot understand it. The sum of £48,109, which on June 30, 1866, was the amount of invested capital, is carried forward in the following year as £49,092, a sum in excess by £982.

Then they have put in the balance-sheet of 1866, "Add extensions made during the year, £613," and "Add the cost of the Staffordshire Potteries Act, 1866, £564?"—Yes.

The CHAIRMAN: On the other side appears: "Additional capital expended since Act 21 & 22 Vict., £5499;" that would account for a portion of it, would it not?

Witness: That does not account for the difference.

Have not these accounts to pass some audit?—No.

Mr. RICHARDS: Turn to another year. In 1867, including the extensions, a total carried out of £50,274.

Witness: Yes.

Now turn to 1868, and you find it carried out £50,904, with a deduction for depreciation, no extensions being made during the year, and so it stands at £49,898?—Yes; in the first instance they have brought the amount forward. That capital in 1867, which was £50,274, has never been increased at all by any extensions in 1868, and yet they have brought it forward at £50,904, there not being a farthing spent, according to their accounts.

Then on the balance-sheet there is "Deduct for depreciation, £1005?"—That is the sum which they have taken from revenue. They say, "Cost of works, £50,904;" and then, "Deduct for depreciation, £1005;" and in that way they apply the depreciation to the capital. As Mr. Michael put it the other day, as the 50 years is about expiring, one would have thought they would depreciate the 10 per cent., but they only depreciate the 7½ per cent.

Examination continued: Another item in connexion with these accounts, which shows that they are not reliable, is that in the year 1867, amongst the liabilities of the company they put "fittings on hire," while those fittings are actually assets belonging to the company, who let them to the consumers, and for which the consumers have to pay. There is one advantage which the corporation would have in taking over these works, and which appears to have accrued to companies in our immediate neighbourhood, and that is that they have realized upon their bank accounts substantial sums for bank interest. There is not a single farthing that I can trace in all these years that the British Company have ever had on their revenue account for bank interest. The Corporation of Hanley are allowed 2½ or 3 per cent. upon all surpluses they have had during the last 17 or 18 years. The British Company might have realized a very considerable sum for interest, and if the corporation had had the undertaking, there would have been a considerable profit to the consumers upon that. The accounts prepared by the company are nothing like those prescribed by the Gas-Works Clauses Act, 1871. I wish to call the attention of the committee to the fact that, notwithstanding the statement that these dividends have been realized, yet the company have paid their shareholders on the Staffordshire Potteries capital their maximum dividends, and more than their maximum dividends; and the five or six local shareholders have never heard of such a thing as the 7½ per cent. capital. I do not know that they have always received 10 per cent., but the 7½ per cent. capital is entirely unknown to them, and they say there are no ear-marked shares.

The CHAIRMAN: We know that this company have works at different places?

Witness: Yes; and all of them failures.

Examination resumed: With regard to the £6000 alleged to have been spent on the consumers company, I cannot find any trace in the accounts. I can only trace the payment of £1500 in cash.

Mr. JEUNE: The total charge is written off portion by portion each half year.

Mr. RICHARDS: Written off what?

Witness: In the first instance it is not written off revenue at all, except to the extent of £1500, because the profit and loss accounts are entirely silent upon the matter. From 1866 to 1869 there is no such item, and it is not until 1870 that, for the first time, appears "Balance of amount paid to the Hanley Gas Consumers Company, £1500." I cannot give any explanation of that unless there are some other assets which these accounts do not disclose.

The CHAIRMAN: Am I to understand that the object of the examination-in-chief has been to show that these accounts have not been properly kept—that is to say, that they have been cooked?

Mr. RICHARDS: I am far from saying that; but we are working in the dark. I am aware that their Act of Parliament does not require the strict accounts required by the Gas-Works Clauses Act, 1871; but I wish the committee to understand the difficulties we have to contend with.

Mr. JEUNE: We have not chapter and verse for every one of these figures; but, of course, we can give it.

The CHAIRMAN: I want to know the principle upon which you charge depreciation, because it is not at a fixed rate of so much per cent. upon the works.

Mr. JEUNE: The 2 per cent. is charged on the capital for the time being. Take the year 1868—"Cost of works, £50,904; deduct for depreciation, £1005." There are no extensions, so it works out to £49,898. Then you will see 2 per cent. on cost of works for depreciation, £1005, which is about one-fiftieth, or 2 per cent.

The CHAIRMAN: Is it a fixed sum?

Mr. JEUNE: Yes.

The CHAIRMAN: Here is the cost of works in one year £50,904, and in the year after, when the works could not have cost less, it is put at a smaller sum, and that, to me, is at present unintelligible.

Mr. MOULTON: In no case is it exactly 2 per cent.

Mr. JEUNE said an explanation should be given when the accountant was called.

The CHAIRMAN said there was not a large amount wrong, but it required an explanation.

Cross-examined by Mr. JEUNE: I do not make any charge against the management of the company, but the inference I draw is that the Hanley

station was not attended to so much as it would have been by a local direction. The item of "depreciation" has been charged to revenue, and written off capital, when there has been no further capital expended. In 1868, for instance, the 7½ per cent. on capital was £7288, and in the following year it by some means or other got down to £6963.

Mr. JEUNE: Having looked at the Act of Parliament, did you take the trouble to inquire how it was that that charge was made regularly to that amount?

Witness: I did not take the trouble to inquire except through the town-clerk.

You never inquired how it found its way into the schedule of the Act of Parliament?—No; I did not. It found its way into the accounts long before that Act of Parliament was passed.

Are you aware that at the time the Bill was before the committee in 1866, that was expressly inserted?—I do not know anything about "expressly inserted," but I know it was there. I do not think it was because the committee required it.

You have not inquired into the circumstances?—No; but I could suggest something—viz., that the company voluntarily wrote to the Corporation of Hanley in 1865, saying, "If you will not support this particular Bill which the consumers are bringing forward, we will insert the amended form of accounts, and will do certain other things."

In that way the form of accounts became prescribed by Act of Parliament?—The form was prescribed by the company. The corporation at that time took no interest in it.

You do not know that in those accounts the charge of 1 per cent. for the half year, or 2 per cent. for the year, for depreciation, is to be found?—I do not. I should be surprised to learn that such a depreciation-fund was formed, and that it consists in the reduction of the amount of the capital.

Look at that account [handing it to witness] of the Birmingham and Staffordshire Company. Do you not find there a charge of 1 per cent. for the half year for depreciation of works?—Yes; but you have to trace if the amount of capital is the same in the following year.

If it was a reasonable thing to do in that case, and if the committee pointed it out as a proper thing to do, isit unreasonable to find it now done by this company?—If the committee pointed it out as a reasonable thing to do, I should have no further remark to make about it, but I believe it was a voluntary act. There were no statutory powers for a depreciation account before 1866, and it was always charged.

Cross-examination continued: I have here the total amounts received by the company from all sources as the produce of gas and residuals for the last 11 years:—

Receipts for the Years 1866 *to* 1876.

Year.	Sales of Gas.	Coke, Breeze, &c.	Bad Debts.
	£ s. d.	£ s. d.	£ s. d.
1866	11,848 6 11	2,203 12 1	613 9 1
1867	12,583 2 0	2,591 17 0	409 12 7
1868	13,190 14 9	2,539 9 0	613 9 1
1869	13,935 12 10	2,662 12 9	627 6 3
1870	15,097 7 4	2,931 4 1	421 8 8
1871	15,900 15 7	2,964 2 2	468 11 5
1872	16,508 10 11	3,248 17 1	270 16 6
1873	18,726 0 11	5,024 1 6	299 3 1
1874	19,049 1 6	7,229 16 6	239 13 6
1875	20,359 13 0	4,968 14 11	212 17 3
1876	33,229 3 4	3,944 19 4	406 5 6
	£180,428 9 0	£40,309 6 5	£4,582 13 11

I have only taken the cash actually received in all cases. I have also the Burslem accounts for 1866.

The CHAIRMAN: Do you think it necessary to go into this?

Mr. JEUNE said it was well known how fallacious comparisons were when all the different items were not compared.

Mr. RICHARDS said the object of that evidence was to show that the company did not conduct their works at Hanley so economically, and to the same profit, as at other places.

The CHAIRMAN said he did not think the evidence was essential.

Mr. JEUNE said after that intimation he would not pursue what would be a most wearisome process.

Cross-examination resumed: The Bill proposes to capitalize the parliamentary dividend on the capital that has been expended at Hanley. They do not propose to allow the arrears of dividends. I know that the company have a central office in London, and that a certain proportion is paid by each of the works towards the expenses of that central office, but I do not know the proportion.

Mr. JEUNE: You know that the gas company have a right to expend a considerably larger amount of capital at Hanley—£20,000 more—and to have 7½ per cent. upon that?

Witness: They had the right to spend, according to the published account, about £13,000 more.

That is an advantage for which there is no compensation in the Bill?—According to the published accounts, the more capital they expend the worse they seem to become.

Your view is that they should not be allowed any compensation for that?—No; it is not my view, nor that of the corporation, who are prepared to make liberal terms.

As to the complaints, all that have been in writing we have had, have we not?—No; the corporation have day by day made complaints to the company in writing.

Cross-examination continued: There have been daily reports of the inefficient state of the public lighting. I have here a book containing the reports of the Watch Committee, a duplicate of which is day by day sent to the British Gaslight Company. [Witness read several extracts from the book.] I suppose that the gas is tested at the works, and I do not say it is tested otherwise than fairly. I should say there was good reason for complaining if the illuminating power was only 15 candles at the works. I am under the impression that the gas ought to be tested at a distance of 1000 yards from the works, but I cannot say whether it would make any difference whether it was 500 or 1000 yards.

Mr. JEUNE: Supposing that is the case, and also that the average is 15 candles, would you agree with me that there was no cause of complaint?

Witness: When you say average, it is quite possible that on one day gas may be produced which will be only of 12 candles illuminating power, and a day or two after there may be something done which would send the quality up to 18 candles, and then you make an average. What we complained of was, not that it was always below the statutory requirements, but that there were many occasions on which it was below.

Cross-examination continued: I do not think there is any depreciation charged at Stoke or Burslem.

Mr. JEUNE: As to the fittings which you say are wrongly charged in the accounts, if the state of things is this, that the fittings are bought in the first instance, and then let out and paid for after a time, in that case are they not rightly charged in the accounts?

Witness: If you explain it that way, I should only say they ought to have been put down under the head of amounts owing by the company. If you say it is a continuation of the item before, that is an explanation of it.

Re-examined by Mr. RICHARDS: With regard to the question of back dividends, I think if the company would meet us we might arrange about that. I do not say we should be prepared to pay all back dividends, because there are some charges made against the revenue account that would have enabled them to have paid the back dividends, but that would be only a matter of a few moments between us.

Mr. RICHARDS: If you have a sum put by annually for depreciation, is it right at the same time to have a regular charge for wear and tear as well?

Witness: No. The wear and tear account ought to come out of the depreciation account, or it ought to be reduced by so much of the depreciation account. It should not be charged twice over.

Mr. *George Ridgway*, examined by Mr. MOULTON.

I am chairman of the Works and Lighting Committee, and in that capacity my attention has been constantly called to complaints about the gas. I have frequently been to the gas-works, and brought those complaints to the notice of the gas authorities. In March, 1874, there were complaints as to irregular and deficient lighting, both from private consumers and as to the public lamps—the late hours at which they were lighted and the early hours at which they were extinguished—and a large deputation waited upon Mr. Haswell. For some little time there was an amendment, but, after a short time, we could not perceive that things were any better. I know of no reason why the Hanley Gas-Works should not pay us as well, and be in all respects in as favourable a position, as those at Burslem and Tunstall. The general feeling of the town of Hanley is decidedly in favour of the application that is being made—I may say rather to my surprise.

Cross-examined by Mr. JEUNE: My surprise was that the town should sanction the application to Parliament knowing the opposition that we were to have from the company. I am not aware that the number of consumers is only 4000 out of about 45,000 inhabitants. That is a very small amount, but, if the gas-works had been liberally managed the people would have used more gas generally than they have.

Re-examined by Mr. MOULTON: No attempt has been made to carry the Bill against the wishes of the consumers, in order to benefit the non-consumers.

Mr. *Anthony Shaw*, examined by Mr. MOULTON.

I am chief bailiff for Burslem, and had the principal part in the negotiation for the transfer of the gas undertaking to the local board. I am a shareholder in the British Gaslight Company, but do not on that account object to the proposed transfer. I understand the offer of the Corporation of Hanley is equal to £60 a share, which I consider a good price; it is a little more than we are going to give the Burslem Company.

Mr. *John Sugden Crapper*, examined by Mr. MOULTON.

I am a magistrate for the borough of Hanley, and carry on business there as a manufacturing dentist. I burn a good deal of gas, both in the day as well as in the evening, but I have found the supply very indifferent till within the last few months. I have had to suffer very materially from having inferior gas supplied; my *employés* have had to leave their employment in order to avoid the bad odours arising from the gas. We have also suffered by not having sufficient pressure. Three years ago I had an independent sewer carried into the main sewer, on account of the very offensive odour, which we thought arose from that source, whereas after I had been to that expense the offensive effluvium remained the same, and it turned out to arise from the gas.

Cross-examined by Mr. JEUNE: I have invariably taken a walk out, and avoided it as much as possible; but still I suffer from headache, and so on. I addressed numerous complaints to the company in writing on the matter. I also complained on one occasion of being charged too much. The price in 1876 was £6 6s., and the amount sent in in March, 1877, was £10 17s. 9d., and I applied for some abatement. In reply the company stated that the index had been correctly read, and the only explanation the inspector could give of the increase of consumption was that a larger service-pipe had been laid into my manufactory to enable me to obtain a more ample supply of gas, and that due care had not been exercised in its use. They also stated that the meter registered against the company, and requested me to remove it, and have it replaced by a correct instrument. The meter, however, was not my own property, but belonged to the gas company.

TUESDAY, MAY 1.

Mr. *Matthew Folliott Blakeston*, examined by Mr. RICHARDS.

I am clerk of the peace for Staffordshire, and town-clerk of Stafford. I was formerly town-clerk of Hanley, and a resident in that borough for 19 years. Up to a short time since very great dissatisfaction was expressed respecting the supply of gas. In 1865 a Bill was promoted for the establishment of another gas company, and I was joint solicitor for that Bill, which was four days before a committee of the House of Lords. The Bill was ultimately withdrawn on the British Gaslight Company agreeing to provisions for increasing the illuminating power of the gas, reducing the maximum price, and paying the costs of the proceedings. I am decidedly in favour of gas-works being in the hands of corporations. In the case of Stafford, a general Improvement Bill was passed last year, which included clauses for the compulsory purchase of the gas-works. Consequently, notice was served upon the gas company, and negotiations are now going on with respect to the transfer. In my opinion great advantages result from local officials having charge of gas-works and undertakings of that kind, because a better supervision can be exercised over them. The collection of rates in a general form would also be advantageous, and there would be a considerable advantage from the consumers being able to come into direct contact with the town council as to complaints. The Manchester system of collecting the rates on one slip is a great advantage to the ratepayers as well as to the corporation.

Cross-examined by Mr. JEUNE: The board in London is utterly inaccessible, except through their manager, and the manager's interest is to make as much profit as he can for his directors, and the more he makes the better they are pleased. There is, however, no difficulty in the way of anybody going to the local manager, and telling him any complaint they have to make. I had forgotten that power was given by the Act to take the company before the magistrates if the requirements imposed by that Act were not complied with. I think it would also be a good thing for the Hanley Corporation to have the water supply in their hands, and my argument would be for their getting it—going by steps. I believe the case of Wigan is a solitary instance of non-success.

Mr. *Frederick Wragge*, examined by Mr. RICHARDS.

I am chief manager of Earl Granville's iron-works at Hanley, a magistrate of Staffordshire, and of the borough of Hanley, chairman of the North Staffordshire Coal and Ironmasters Association, and chairman of the Hanley School Board. Earl Granville is by far the largest ratepayer in the borough. He was assessed upon a rateable value of £10,000, apart from the Shelton Bar Iron-Works, in which he was also a partner. He was a

rather large consumer of gas—about 1¼ million feet per year being used on the works I manage, exclusive of the rolling-mills at Shelton. About 2000 men are employed at the works I superintend. I have occasionally made complaints respecting the unsatisfactory supply, but I make great allowance for the company, because the directors, living 160 miles away from the works, necessarily cannot look after them like people in the district. I believe that if these gas-works were in the hands of the corporation there would be much sooner remedies to complaints than now. At one time we contemplated setting up works of our own, but we found we should have to encounter difficulties, such as breaking up roads and going over people's lands, which we could not do without special legal power, and therefore we gave up the idea. We are not only dissatisfied with the quality supplied, but also with the charges made, the result of the reading of the meters being quite incomprehensible. We are charged more and more by the same meter without our being aware of our having consumed more gas. I believe the Corporation of Hanley are fully competent to carry on the gas-works satisfactorily, and I am not in the least degree apprehensive of any risk being run in such transfer, nor any loss occurring.

Cross-examined by Mr. JEUNE: I have only made verbal complaints—none in writing. I have experienced the delay of communicating with London in another way. I used to buy considerable quantities of coke from the manager, and he always had to wait for a board meeting before I could get an answer

Mr. *Frederick Llewellyn*, examined by Mr. RICHARDS.

I am chief manager of the Shelton Bar Iron Company, employing about 1000 hands, and consuming a large quantity of gas. The company are very large ratepayers in the borough of Hanley. We have had very considerable difficulties with the British Gaslight Company about the supply of gas, In 1876 our works were interfered with to a great extent through the want of a good supply of gas. The men are at work night and day, and some portions cannot be carried on unless they have gas or some artificial light. We had a correspondence with the manager at Etruria during the last year, extending over three or four months, complaining of the insufficient supply of gas. During 1874 the stench of the gas was very great, and unbearable in the offices and engineering shops. There was also a correspondence with regard to the quantity of gas passed through the meters, or that they had charged us for. In reply to that complaint, an answer was received to the effect that, on the inspector taking the pressure on the main at the inlet of the meter, an ample supply of gas could be obtained, and that an examination of the meter showed that it was working properly, and that therefore the gas was either used or wasted. The company also stated that, if the amount owing (£35) was not paid, the supply of gas would be discontinued. Further correspondence ensued, and, on the 9th of April in the present year, we received a letter from them stating that they had cut off the supply. I immediately took a solicitor, and saw Mr. Linging, and pointed out that the consequence would be serious if the works could not go on that night, and they then reconnected the pipes, and there has been no further correspondence.

Cross-examined by Mr. JEUNE: We paid the account for March 25, because it was perfectly in order, and was on the average of preceding years. We had done nothing to the fittings before that quarter; the only alteration was that the company changed a meter. From August to the middle of November the gas frequently went out after twelve o'clock. I suppose the street-lamps were burning at that time, but I did not notice them particularly. In consequence of our complaints, the company repaired their main from Wedgewood's works to our works. The manager visited the works at night on two or three occasions, and saw that the gas was burning badly. The lights supplied by the particular meter which was removed were burning very badly, showing there was some defect in the main-pipe. We tried the pipe by attaching it to the boiler, and forcing in steam at 40 lbs. pressure, and there was not an escape of steam found anywhere. Mr. Linging, the manager, and his inspectors, saw this going on, and that convinced him that there was no defect on our side of the meter.

Re-examined by Mr. RICHARDS: If we had had to bring these complaints before the corporation, no doubt they would have been remedied the same day.

By the CHAIRMAN: We did not make any complaints to the magistrates in consequence of the bad supply of gas to our premises.

Mr. *Arthur Lee Sparkes*, examined by Mr. RICHARDS.

I am a Bachelor of Arts of the London University, a Fellow of the Chemical Society, and have been a lecturer on chemistry in connexion with the Science and Art Department for several years. I have had experience as an analyst of gas for the last six years, and am at present gas analyst to the Corporation of Hanley, and also to the Corporation of Newcastle-under-Lyme and to the Local Board of Tunstall and Fenton. The first examination I made of the gas at Hanley was on Dec. 24, 1874, and the last was on April 14, 1877. In December, 1874, the average illuminating power was 13·70 candles; in January, 1875, 14·89; February, 15·22; March, 15·75; April, 15·14; May, 14·74; June, 15·21. Then I have no report till September, when it was 14·89; October, 12·75; November, 15·58; December, 14·77. In January, 1876, it was 15·08; February, 15·21; March, 15·33; April, 15·23; May, 14·85; June, 15·10; August, 15·10; September, 15·49; October, 15·62; November, 15·49. The gas has been better during the present year; in January it was 15·47 candles; in February, 15·41; and in March, 15·94. I also tested the gas for impurities, and found that sulphuretted hydrogen was present in December, 1874, for ten days, but it varied considerably. The average for the whole period, from December, 1874, to March last, was 21·67 grains per 100 feet. An alteration began to be made in May last year, and since then it has never exceeded 20 grains. In January, 1875, it amounted to 35·39 grains per 100 feet. In October, 1875, it was 35·27 grains. With regard to the illuminating power on Nov. 14, 1875, the gas was only equal to 11·89 candles, but that was the lowest of the month. There were also several other occasions, during October and November, when the gas was under the standard of 14 candles.

Cross-examined by Mr. JEUNE: I do not find any difficulty in the application of the sulphur test.

Mr. JEUNE: It is a very difficult thing to make a gas so that it will show a very good result by the sulphur test—there is a very great difficulty in collecting the sulphur, is there not?

Witness: Yes.

So that even with great care there may appear to be a large amount of sulphur present?—Yes.

In fact, that is so much the case that that test is now very little thought of?—It is the one that is adopted; it is the Referees test.

It is one which in modern inquiries people are apt to think ought to be put on one side, is it not?—Professor Valentin and others think they have succeeded in getting a better one.

Even with extremely well-managed works it may happen that more than 20 grains of sulphur are sometimes shown?—Yes.

Since May of last year the sulphur in the gas has been always under 20 grains, and that shows evidence of very good working?—Yes, I think so.

With regard to the illuminating power, are you aware that between the 13th of October and the 15th of November the exhauster broke down, the effect of which would be temporarily to raise the quantity of the sulphur in the gas?—I am not sufficiently acquainted with the manufacture of gas to answer that question, but it might do so.

Did you test the gas with your own candles or those of the gas company?—Part of the time with my own, and part of the time with those of the company.

It is difficult sometimes to read the photometer right, is it not?—It requires a good deal of practice to read it correctly.

Was there not one time when you were examining the photometer and the gas manager of the company came in and found you were making a mistake, and reading it too low?—I was reading it too low for him.

Do you not remember that he said you were reading it at 12·50, when you ought to be reading it at 15?—It is possible he might have said so, but I should not have been influenced by him if he had.

Cross-examination continued: I should not like to offer an opinion upon the management of the Stoke Gas-Works, as I know nothing about them. I think a very great many complaints arise from bad fittings, both at Hanley and elsewhere.

Re-examined by Mr. RICHARDS: The candles I used when I arrived at results unfavourable to the company were the same as those used when the results were favourable.

Mr. *Arthur Silverthorne*, examined by Mr. RICHARDS.

I am a civil engineer, practising in Westminster, and also engineer to the gas-works in La Vendée, and others in the South of France. In 1874 I was retained, on behalf of the Corporation of London, to give evidence before the commissioners appointed by the Board of Trade, in the case known as the Chartered revision. I was also engaged by the Corporation to report on the Metropolis Gas Regulation Bill, 1875.

Mr. RICHARDS: You have been retained on a good many Bills, on one side or the other, in parliamentary committees?

Witness: I have had some experience within the last five years. I have been consulted by the Corporation of Hanley, and I entirely concur in the objects of their Bill. I think the terms offered by the corporation are very liberal. I am acquainted with most of the transfers which have taken place since 1868. I remember the case of Glasgow, where the corporation offered certain annuities which the company refused, at first, to accept; but the committee expressed an opinion that they would practically pass the Bill upon certain terms, and that led to an arrangement being accepted by the company. In the Rotherham case the committee actually went further, and pronounced a decided opinion. In the Stockton and Middlesbrough case it was actual compulsion. So far as my experience goes, under the very trying circumstances of the last three years, the corporations supplying gas have performed their duties satisfactorily.

Mr. RICHARDS: You observe in the accounts of the company a certain charge appears for wear and tear, and then also 2 per cent. is charged for depreciation; is that your usual experience of gas accounts?

Witness: It is provided for in the form of accounts used by the British Gaslight Company, but I am of opinion that it acts injuriously as regards the consumers.

But the form of accounts, whilst it provides for a per centage of depreciation, does not necessitate also a charge for wear and tear?—That rather proves that it does act disadvantageously, because if the company raised the amount for depreciation the inference would be that the injury would be greater. Taking the period from 1859 to 1876, the amount actually paid as depreciation has been £17,880 7s. 8d.

Can you trace in the accounts what has become of that sum so alleged to be charged to depreciation?—I think it is most probable it has been invested in the works.

If it had been treated as part of the balance of profit and loss, then the company would have been able to pay their full dividends?—If they had treated it in another way, they would have had an excess to pay on dividend, but the injury to the consumers is due to the excess on dividend being less than the actual amount paid in that depreciation.

Examination continued: There is no doubt that a large amount must have been expended, because the manufacture of gas cannot be carried on without capital, and consequently the capital must be obtained somewhere. This company have been practically 19 years at work, and with only a small amount of new capital raised, which they state to be £14,000, but it would have been utterly impossible to carry on the works with that amount. The company have refused the actual figures, but I have made a calculation, by which I make out that in 1865 the supply must have been 72 millions, while it is now probably 135 millions. In 1866, upon these figures, the capital would have been £665 per million feet sold, and in 1867, £668, while in 1876 it would be only £425. I gather from that, that there must have been a greater increase of capital than the £14,900, which is shown in the accounts. It appears from the accounts of the company that they have expended in extensions, from 1859 to 1865, about £10,526, and from 1866 to 1876 about £17,674, being a total of £28,200, so that there must have been a difference of £13,000 written off. With regard to the price of gas, which is 3s. 6d. at Hanley and only 2s. 6d. at Hull, I am of opinion that it could be supplied at Hanley for 2s. 8d. I arrive at the calculation in this way:—The net cost of manufacture at Hanley should be 1s. 9¾d.; add for capital of the company 9·57d., and a reserve-fund of 1 per cent. upon the capital, bringing it to 1·03d., which gives a total of 32·32d., or a selling price of 2s. 8¼d.

Cross-examined by Mr. POPE: I have had experience as a gas engineer for the last twelve years.

Mr. POPE: How old are you, because you give your opinions *ex cathedrâ* in a way that astonishes me?

Witness: I have had a good deal of experience. I was with Mr. Hughes for six years, until his death in 1871, and then I practised on my own account. I am an advocate for compulsory purchase.

Have you yet been able to convert Parliament to your opinions?—I think Parliament is already converted.

Tell me any instance in which there has been a compulsory purchase of gas-works?—Rotherham.

Were not the Rotherham Gas Company before the House with a Bill of their own?—Yes.

Are the British Gas Company before Parliament with a Bill of their own?—I do not see the difference.

The Rotherham Company were before Parliament with a Bill of their own, and an agreement was come to in the lobby?—I cannot accept it as an agreement; so far as this House was concerned, it was a decision.

Do you know the case of the Thanet Gas Company, in which Parliament refused two years together to sanction the compulsory purchase of the company by the local board?—The works are in the hands of the local board now.

By an agreement which was scheduled to the recommitted Bill in an adjoining room?—I say that the case of water being mixed up with gas has something to do with it. They have the same chairman, the same board, and the same solicitor.

They have not the same board nor the same solicitor?—I stand contradicted.

You had better acquaint yourself with facts before being so positive. I do not understand the relevancy of a great deal you have been telling the committee?—It shows that the management at Hanley might be better,

and that the corporation have a right to say, "Give us the management, as you have not been managing the concern so well as we could do it."

Have you considered the effect of the sliding scale, of the auction clauses, Mr. Forster's report, and the other matters which have been before Parliament so often?—I do not see that the principle of compulsion is affected, although it may induce companies to manage their affairs better.

I understand you to say that though Parliament has hit upon a plan which may induce companies to manage their affairs better, you think Parliament has made a mistake, and it ought to compel them to hand over their property to somebody else?—Parliament has put that pressure upon companies, and it may result in having the desired object.

In the meantime, why should not you let it have its desired object instead of compulsorily taking people's property?—Because we can put our fingers on facts that warrant us in coming forward in this particular case.

What are they?—Complaints, and the fact that the corporation would be enabled to extend the capital at 4 per cent. instead of 7½ per cent.; and I consider that in any particular case that argument is supreme, because as long as a concern is in the hands of a company you must raise the capital for extensions at 7½ per cent., but directly it merges into the hands of a corporation it is raised at only 4 per cent.

What do you suppose the effect of the auction clauses really is?

Mr. Richards: The auction clauses have nothing to do with this company.

Mr. Pope: They have everything to do with us, if Parliament puts them upon us.

Re-examined by Mr. Richards: I do not think the British Gaslight Company are likely to come to Parliament for the next 19 years, because if they did, they would be placed under the restrictions of those auction clauses. I look upon the case of Rotherham as one of absolute compulsion. In the case of Glasgow, it was not so absolutely compulsory, because the company anticipated the decision of the committee, but the committee had pointed out the terms which they thought fair and liberal.

Mr. Richards said that was the case for the promoters.

The committee-room was ordered to be cleared, and, after a short interval, the counsel and parties were again called in.

The Chairman said: The committee are of opinion that the promoters have not proved the preamble of their Bill; but at the same time the committee wish me to express their opinion to the company that they have given at times very just cause of complaint, both as regards the supply of gas, and as regards the want of illuminating power.

Legal Intelligence.

YORKSHIRE (WEST RIDING) SUMMER ASSIZES.

Leeds, Wednesday, Aug. 1.

(*Before Justice* Lush.)

REGINA *v.* COLNE VALLEY GAS COMPANY.

Mr. Digby Seymour, Q.C., Mr. Cave, Q.C., and Mr. Shaw appeared for the plaintiffs, the Longwood Gas Company; Mr. Wills, Q.C., Mr. Waddy, Q.C., and Mr. Forbes for the defendants.

Mr. Seymour, in stating the case, said the question to be tried was one upon which a verdict was pronounced by a jury at the last assizes [see Journal, vol. xxix., page 498], and as to which a new trial was granted on the ground of a misdirection by the learned judge, Lord Coleridge [see Journal, vol. xxix., pages 630 and 781]. It was impossible to discuss the questions which would arise without referring to Lord Coleridge's ruling at the time, and to the judgment of the Court of Queen's Bench, presided over by Justices Mellor and Field, who made an order granting the present new trial, not on the ground that the learned judge did not lay down good law in directing the attention of the jury to a principle involved in the case, but that he laid it down so strongly in favour of the prosecution that, in effect, he told the jury that the only verdict they could come to was a verdict of guilty against the defendants. The Court above, jealous, and rightly jealous, of the functions of judge and jury, thought the matter had been put more strongly than it ought to have been, and that it ought to have been left a question for the jury.

Justice Lush: It is quite unusual in a matter of this sort to refer to a former trial. Why not open the case as if the trial had never taken place?

Mr. Seymour thought that, in discussing a point of law, the ruling of the judges he had mentioned would be material. He said he represented the Longwood Gas Company, who had been registered under the Joint-Stock Companies Act, and were subsequently incorporated, subject to various amendments, by the Longwood Gas Act of 1875. The company were formed, for the purpose of lighting Longwood and other places in the vicinity of Huddersfield, so far back as the year 1859, at which time there was no other company competing with them, and hence they were masters of the situation. In the course of time the company purchased the gas-works of Messrs. Armitage, and laid down a considerable range of plant. The line of their works extended over an area of several miles.

Mr. Wills: Have we anything to do with what the Longwood Gas Company did?

Justice Lush: It is not a matter of competition between two gas companies.

Mr. Seymour: One of the questions will be—Was this an obstruction if it was to supply a necessity?

Justice Lush: Supposing some person thought a hamlet ought to be supplied with water, that would not justify a breaking up of the public highway. The question is—Have the defendants so far obstructed the public highway as to amount to a nuisance? That is the only question I must try.

Mr. Seymour, continuing, said that in spite of opposition, the company obtained an Act of Parliament, which received the Royal Assent on April 19, 1875, and by that Act they were incorporated and received parliamentary powers.

Justice Lush: Really we have nothing to do with the Longwood Gas Company. The question is whether the defendants have been guilty of a common nuisance.

Mr. Seymour said the real plaintiffs were the Longwood Gas Company, and that the Queen's name was only introduced because it was a nuisance or injury which affected the public in general that was complained of. What was alleged was that the defendants disturbed the soil of the Queen's highway, and obstructed the use of it, by laying mains and other appliances and machinery, for the purpose of supplying gas to houses within the district of Longwood. He contended that the acts of the defendants were acts which, in law, amounted to a nuisance. On the 6th of October a hole, 6 or 7 feet long and 4 or 5 feet wide, was dug in the road, the soil was thrown out so as to interfere with persons passing, and was left there for a considerable period.

Evidence similar to that given on the former trial was then adduced—viz., that the defendants had a broken gas-main in the road at Longwood, and that they sent on the 6th of October last to repair it. Their men began to work early in the morning, but no sooner had they thrown earth out than an opposing gang of men, belonging to the Longwood Gas Company, threw it back again. Thus the work was greatly delayed, and to witness the proceedings a crowd of mill hands and others, to the number of 2000, assembled.

After hearing the arguments on both sides as to whether the obstruction amounted to a nuisance in law,

Justice Lush decided that the question the jury would have to answer was whether the interference with the road was to such an extent, and continued for such a length of time, as to produce substantial inconvenience to persons passing along the road.

Mr. Wills contended that if it had not been for the lawless proceedings of the Longwood people, the work of repairing the pipe would have been done without any inconvenience whatever to any one.

A large number of witnesses having been called for the defence, his lordship summed up, and the jury found a verdict for the defendants.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

Dr. Stevenson's report on the gas supplied by The Gaslight and Coke Company to the Vestry of St. Pancras, during the month of July:—Maximum light, estimated by sperm candles, according to the Act—16·8. Minimum light, sperm candles—16·0. Average light, sperm candles—16·4. Traces of ammonia, indicated by turmeric test-paper—Traces on all occasions. Traces of sulphuretted hydrogen, indicated by lead test-paper—none. Sulphur, 11·6 grains per 100 cubic feet of gas.

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health, on the composition and quality of the metropolitan waters in July, 1877:—

Names of Water Companies.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitrogen. — As Nitrates &c.	Ammonia. Saline.	Ammonia. Organic.	Hardness (Clarke's Scale). Before Boiling.	Hardness (Clarke's Scale). After Boiling.
Thames Water Companies.	Grs.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	17·09	0·052	0·120	0·001	0·007	11·0	2·8
West Middlesex	17·10	0·053	0·105	0·000	0·007	11·8	3·3
Southwark and Vauxhall	20·70	0·050	0·090	0·001	0·008	12·1	2·8
Chelsea	17·40	0·057	0·090	0·000	0·007	12·1	2·4
Lambeth	17·00	0·052	0·120	0·000	0·009	11·8	3·3
Other Companies.							
Kent	26·70	0·015	0·300	0·000	0·003	17·0	5·1
New River	16·40	0·019	0·120	0·000	0·006	12·1	3·3
East London	18·39	0·046	0·090	0·000	0·007	12·1	3·3

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it.

The water was found to be clear and nearly colourless in all cases but the following, when it was slightly turbid, namely:—Grand Junction, West Middlesex, Southwark and Vauxhall, Chelsea, and Lambeth.

C. Meymott Tidy, M.B.

METROPOLITAN WATER SUPPLY AND THE EXTINCTION OF FIRES IN THE METROPOLIS.

Extract from the Report of the Select Committee of the House of Commons on the Metropolitan Fire Brigade.

(*Continued from page* 180.)

The questions, therefore, that present themselves are these:—What are the conditions necessary for the effective employment of hydrants; to what extent are these conditions satisfied under the existing system of metropolitan water supply; and what would be the cost of providing hydrants? It will be more convenient to consider the last question first.

The cost of adopting a system of hydrants depends on the cost of each hydrant and the number of hydrants required. With respect to the cost of providing and fitting a hydrant, a variety of circumstances have to be taken into consideration. Much would turn on the character of the hydrant itself, according as it is simple or elaborate in construction; much on whether any extra work, as the construction of a small branch to receive the hydrant, is required; much on whether the hydrant is to be affixed to a pipe already laid down, a process entailing not only extra work on the pipe, but the necessity of breaking up the road and making it good again, and the expense of this latter operation itself varies according as the material of the road is earth, pavement, wood, or asphalte, and as the road is a crowded thoroughfare or otherwise, for in a crowded street special precautions and night work at extra pay are indispensable. How wide is the range of cost may be estimated from the fact that the simplest hydrant, as used at Manchester, by itself can be procured for the sum of £1 10s. 8d., whereas the expense of providing, fitting each hydrant, and doing the necessary work in connexion with it in the City of London will probably amount to from £25 to £30. In the case of the Metropolis, the additional cost resulting from the hydrants having to be affixed to pipes already laid down would be unavoidable, and in some streets the special difficulties would be as great as in the City. On the other hand, there are many parts of the Metropolis in which the work would be of an inexpensive character.

With respect to the number of hydrants required, it is difficult to form any trustworthy estimate from the length of the actual pipeage in the Metropolis, or from comparisons of the area and population of the Metropolis with those of provincial towns where hydrants have been adopted. It is certain, however, that throughout the parts covered with continuous buildings, as distinguished from the comparatively rural portions, hydrants must be placed at short distances from each other, since every additional length of hose attached to a hydrant greatly weakens its powers of discharge; and to ensure success it is necessary that there should be the means of bringing several hydrants to bear on the fire at once. The number, therefore, of hydrants required for the entire Metropolis could not fail to be very large. The gross cost was estimated by different witnesses at sums varying from a quarter of a million to a million, but this sum would, of course, be greatly reduced if, for the present, hydrants were to be placed only on such mains and service-pipes as now receive a constant supply.

Next as to the conditions necessary for the effective employment of hydrants. This question your committee propose in the first instance to consider as it was presented by the witnesses on behalf of the Metropolitan Board, who directed their evidence to the availability of hydrants, not as feeders to fire-engines, or as appliances to be used before the arrival of the engines, but as a complete substitute for them. The first condition which was specified as necessary for this purpose was that of constant supply. Not that constant supply has any bearing on the force of the

hydrant, an intermittent supply, when once water is obtained, being equally effectual in this respect. Under the intermittent system water cannot be obtained without the help of a turncock; and the interval of time requisite to enable a turncock to arrive is sufficient to enable a fire-engine to arrive also; and a fire-engine once on the spot, leaves nothing for the hydrant to do, except to feed the engine.

Next it was urged hydrants must be able to throw a jet sufficient in height and volume to reach and extinguish any fire with which they may have to deal. The necessary height will be the height of the tops of the houses and buildings in the street, and would vary, therefore, from 50 to 80 or 90 feet, or even more, above the level of the pavement. The volume which Captain Shaw declares to be necessary in the case of a large fire is a discharge at the rate of 2000 gallons per minute, to be distributed through 12 or 14 engines or hydrants. This may be taken as the maximum. Now, the height and volume of a jet are regulated by certain hydraulic laws which cannot be adequately expounded except in a scientific treatise, and are very difficult even for experts to apply to the varying and complex circumstances of each case.

The general result, however, of the evidence given on behalf of the Board was, that the conditions to be realized before a system of hydrants can be relied upon as a substitute for fire-engines are—constant supply, high pressure concentrated on the point of delivery, pipes sufficient in diameter and traversing a moderate distance, and hydrants disposed at narrow intervals so as to be available without an excessive length of hose.

These conditions are admitted to be realized with marked success in some provincial towns which possess special local advantages in respect of water supply, and which have had their pipeage laid down with a view to the use of water, not only for consumption, but for the extinction of fires. Such is the case at Liverpool, Manchester, and Brighton, where the water-works are in the hands of the corporations, and arrangements exist for immediately bringing to bear the highest available pressure, and the police are employed in working the hydrants. Engines are not discontinued, but they are reduced in number, and used chiefly by way of reserve. In Manchester it appears that in only 3 per cent. of the fires is it found necessary to call in the engines.

The conditions are also realized beyond question in parts of the Metropolis. In the City of London, where the supply from the New River Company is intermittent, but the mains are constantly charged, the Corporation have already erected some hydrants, and are about to adopt the system more extensively. Their first commencement was in the Holborn Valley District; when carrying out in that district the recent Improvement Act, which compelled them to lay down new pipes, they took the opportunity of supplying the new mains with hydrants, and Captain Shaw appears to be satisfied with their efficacy. At the present time the Corporation are engaged in establishing hydrants at their own expense in one of the six police districts of the City, and from experiments made they have good reason to believe that these hydrants will give a jet which will be thoroughly serviceable in respect of both height and volume; and if the result proves successful, hydrants will doubtless be extended to the whole of the City. With respect to the work now in hand, the arrangement is that the hydrant shall be placed either on the main itself or (in the case of streets which are without a main) on a branch which the Corporation lays down for the purpose. The cost of making and laying of each branch is about £16, and the cost of each hydrant, of the form which has been provisionally adopted, is £6 16s. 3d.; so that the total cost of providing and laying down such a hydrant will probably amount to from £25 to £30. The pressure given by the New River Company is greater than that of any other company, and is about to be enlarged by the addition of 50 feet head available in two-thirds of the City. The mains are large, and the branches having been constructed expressly with a view to the use of hydrants, are of sufficiently large dimensions, and of not excessive length; indeed, the area of the entire City is only one square mile. The cost of laying down the hydrants is comparatively much higher than would be requisite elsewhere, whilst the value of property in the City warrants an exceptionally large expenditure.

In the Temple, which is likewise supplied by the New River Company, the Inns of Court have lately caused hydrants to be established, but as a preliminary step they deemed it necessary to construct a new 7-inch main to connect with the 12-inch main in Fleet Street and the 7-inch main in Whitefriars, and attached to the main in the Temple branches to which the hydrants are fixed. The hydrants themselves, and their fixing, cost on an average £4 3s. 3d. apiece, and from the experiments made it is the belief that they can throw a jet sufficient both in height and volume.

In parts of the district belonging to the Kent Water-Works Company hydrants have been laid down systematically. The earliest were those at Greenwich and Woolwich, erected before the transfer of the brigade to the Metropolitan Board, and at the request and cost of the local authorities. Greenwich Hospital, Woolwich Dockyard, and Deptford Victualling Yard are all efficiently hydranted, a suitable main having been laid down for the purpose. Further, as already stated, 30 hydrants have been erected by the direction of the Metropolitan Board in Rotherhithe and Deptford as the constant supply system was extended to these districts. Of these the first 11 were of different kinds and prices, selected with a view to experiment; the remaining 19 cost £4 15s. apiece; these were tried in the presence of Captain Shaw, and the results pronounced satisfactory; and more recently Plumstead district has been hydranted by the same company, at the expense of the Board, each hydrant costing (without a stand-post), on the average, £3 6s. 11d.

Nor is there reason to doubt that there are many other districts in the Metropolis where hydrants could be used as engines if affixed to mains, or even to service-pipes. Your committee, however, are of opinion that this cannot be taken to be the case with the Metropolis at large. The service-pipes are often so small in diameter that the utmost pressure within the range of possibility would fail to give a jet at all corresponding to that of an engine. In other cases the pipes may be large enough; but the existing pressure, though adequate for the purpose for which it is designed, would be insufficient for the purposes of a jet.

The proposition, therefore, of the Metropolitan Board that, taking the Metropolis as a whole, hydrants, under the present conditions of water supply, cannot do all that is required of fire-engines, is one which is to be accepted. To argue, however, from this that no hydrants should be used, but only fire-engines, seems to your committee to mistake the problem to be solved, The object is not how to deal with fires at their height, but how to quench them at the outset. For the former, engines will always remain necessary; but for the latter they are not available. The engine is at a distance, has to be sent for, and to come; with the utmost expedition it cannot be brought to bear until after the lapse of many minutes. In the meantime valuable property is being burnt, and what was a small fire has become a large one, perhaps a conflagration. A hydrant, on the other hand, is on the spot, and ready for instant service. That it is not so strong as a fire-engine is not a fatal objection; in most cases not an objection at all. The volume which it can discharge may be small, but if promptly used will suffice to extinguish the fire, or to keep it down until the arrival of the engines. So, again, the jet may fall far short of the roof of a house; but the fire is not always at the roof. If the hydrant can throw a jet on the third, second, or first floor, it may do all that is required; and by mounting a ladder or fire-escape with a hose, the person in charge of the hydrant may be able to deliver water through the window at a place unattainable by a jet from the ground. But even as a mere carrier of water to the door of the house the hydrant renders most important service, as by this means hand-pumps can be at once set to work. The efficacy of hand-pumps so used is fully proved by the experience gained at Manchester, where 72 out of 308 fires were extinguished by hand-pumps. In short, the advocates of the hydrant can appeal to what has been well called the axiom of fire extinction, that small means promptly exerted, are more efficacious than more powerful appliances at a later stage; such axiom depending on the obvious fact that every fire begins by being a small one, and can then be easily dealt with, whereas if unchecked it rapidly gains head, and before long becomes uncontrollable.

But an essential condition to the utilization of hydrants is that there should also be on the spot persons ready and competent to work them. If left to be worked by the firemen arriving with the engine, they would usually be superfluous, except as feeders to the engine. But this condition would be perfectly satisfied by police constables being appointed to the duty, and such an arrangement would naturally form part, and indeed constitute the chief value of the recommendation we have already made for the incorporation of the fire brigade with the police. Provided, therefore, that recommendation be accepted, your committee are prepared to advise that, throughout the Metropolis, hydrants should be placed on mains and service-pipes wherever a constant supply is given.

The outlay requisite for this purpose would undoubtedly be large; but, in the opinion of your committee, the ratepayers, as householders, would be fully compensated by the increased security to their property.

But whilst recommending that the hydrant system should be introduced without delay, and extended to the utmost practicable limits, your committee have to observe that it is impossible for the hydrant system (or, indeed, the fire-engine system) to be worked to the full advantage unless important improvements are effected in the metropolitan water supply; and the question at once arises, how far such improvements can be required from, or carried out by, the several water companies as at present established. The improvements to which we refer are the introduction of constant supply, increase of pressure, and enlargement of pipeage.

With regard to the first of these, it is doubtless within the competence of each company to give a constant supply; but it is not to be expected that the companies generally will volunteer to do so, seeing that, after this lapse of time, six out of the eight companies still adhere to the intermittent system, and the other two have introduced this change only in parts of their districts. Nor is it likely that either the Metropolitan Board or the Local Government Board will exercise the powers they possess, under the Act of 1871, to make requisition on the companies.

With respect to pressure and pipeage, it may be taken that the companies already acquit themselves of their statutory duties, the pressure given and the pipes used being now sufficient for the domestic supply, to which alone the obligation extends. But to make the system of each of the water companies self-sufficient, so that hydrants wherever placed will give a jet of the requisite volume, would require a very large outlay; new reservoirs would have to be constructed, or additional pumping power provided for engines, small or thin pipes would have to be replaced by large and strong ones, and house fittings would have to be strengthened. Your committee are of opinion that the companies cannot be called upon to undertake this expense for the purpose of fire extinction, an expense from which they would derive no profit. No doubt want of pressure, and even of sufficient pipeage, could, to a certain degree, be met by combination between the different companies; but even this would involve fresh legislation, expense in establishing the necessary connexions and in strengthening the pipeage to receive the increase pressure, and, above all, such constant concert in working the arrangements as to pumping, use of the water, &c., as could scarcely be maintained between different companies having conflicting interests.

Your committee are thus brought to the conclusion that the water supply cannot be made to afford the full measure of protection, which the Metropolis should possess against fire, until it is consolidated in the hands of a single authority, conducting the business, not for immediate profit, but for public convenience, and placed under a statutory obligation to provide jets of water sufficient for fire extinction, as well as a supply for domestic consumption. Your committee, however, feel that they would be exceeding the bounds of this inquiry if they expressed any opinion as to the conditions on which such transfer from the companies could best be effected, or as to the question what should be the new water authority, or as to the numerous other points of importance which are necessarily involved in a proposal for so complete a reorganization of the water system of the Metropolis.

But they deem it necessary to observe that, whilst the general result of such a concentration of management as they have indicated would be to secure an effective means of extinguishing fires, and thereby diminish the losses of the Metropolis, the several changes above mentioned in the system of water supply would be capable of being carried out with much less difficulty and expense if unity of control and consolidation of public interests were allowed to supersede the separate action of the various water companies.

Amongst the conclusions at which the committee have arrived, and to which they recommend that effect should be given by the Legislature, the following have reference to water supply arrangements:—

That the statutory arrangements for the extinction of fires in the Metropolis—whereby the fire brigade is administered by the Metropolitan Board of Works, two separate police forces exist side by side, and the water supply is sectionally furnished by eight independent companies—are not such as to furnish adequate protection to life and property, and contrast unfavourably with provincial systems, where the fire brigade, water supply, and police are under a single authority; and that consolidation of management, so far as is practicable, is urgently required.

That hydrants should, without delay, be affixed to mains and service-pipes wherever there is a constant supply, and should follow the extension of such supply.

That the water systems now belonging to the various companies should be consolidated in the hands of a public authority, which, in dealing with the questions of constant supply, pressure, and pipeage, should be bound to have regard not only to the convenience of consumers, but also to the requirements for the extinction of fire.

Rochester and Chatham Gas Company.—The half-yearly meeting was held last Thursday—Mr. E. Winch, the chairman of the company, presiding. The report, which was read by the secretary, Mr. Syms, congratulated the shareholders on the satisfactory state of the company, as, notwithstanding that the price of gas had been reduced to 3s. per 1000 feet, the directors were still enabled to pay the highest dividend which they were allowed to do. The new buildings, retort-houses, &c., commenced after the floods, had been completed, and were in operation, there being no fear of future high tides inundating the premises. The usual dividends of 10 per cent. on the A and D shares, and 7 per cent. on the B and C shares, were unanimously agreed to.

CITY OF POTSDAM WATER-WORKS COMPANY, LIMITED.

The Second Annual Meeting of this Company was held at the Offices, 7, Queen Victoria Street, London, on Wednesday, the 1st inst.—Mr. Francis Bennoch in the chair.

The following report and balance-sheet were presented:—

The directors have to announce that the works have been in operation during the course of the past year, and have stood the test of a severe winter most satisfactorily. A crossing over the Havel, which was postponed for 12 months with the consent of the municipality, was completed by the contractor last June, and enables the company to supply water to the inhabitants of an important suburb. Several extensions of the pipe system have been made this summer, a remunerative return on the outlay having been guaranteed in each instance.

The number of houses connected with the mains steadily increases, and several of the Government establishments are supplied by the company; estimates for the supply of the remainder have been submitted to the authorities, and await their decision. The undertaking is rapidly gaining ground in public favour as its advantages become more generally apparent, and a substantial increase in the number of customers is anticipated during present season.

A recent analysis has been received from Dr. Ziurek, the eminent chemical expert of Berlin, who sums up an elaborate report in the following words:—"The water of the Potsdam Water-Works is a pure, good water, well adapted for drinking, cooking, and domestic purposes."

A balance-sheet has been made up to the 31st of December, as required by the Articles of Association, and is supplemented by a similar statement to the 30th of June last. The sums hitherto received for water-rates and rent of meters extending over irregular periods, and some of the householders having only lately connected, it has been thought advisable to apply such amounts in reduction of capital expenditure on the construction of works, and to open a revenue account from July 1, 1877.

It is suggested that, in future, annual general meetings be held early in the month of February.

Mr. Bennoch and Colonel Burdett retire from the board at this meeting, but are eligible for re-election, and offer themselves accordingly

Mr. Herbert R. Duke again offers his services as auditor.

Dr. *Balance-Sheet, to Dec.* 31, 1876. *Cr.*

Capital account—				Concession, as per last balance-sheet		£5,000	0 0
2378 shares of £20 each, which have been paid up in full		£47,560	0 0	Concession expenses, as per last balance-sheet		2,325	1 6
305 shares of £20 each, on which £16 per share has been paid		4,880	0 0	Construction of works—			
2683				As per last balance-sheet	70,605 14 6		
968 share warrants of £20 each	19,360	0	0	Half yearended Dec.31,1876	23,894 1 0		
3651 shares of £20 each, on which has been paid	£71,800	0	0	Sundry expenditure—			
Amount retained from payments to contractor in respect of interest payable to shareholders, &c.	7,528	7	3	Miscellaneous expenses	31 10 4		
Interest—				Office furniture (London)	8 8 0		
Received from bankers on deposit account	34	13	5	Office furniture (Potsdam)	26 0 6		
Interest on calls in arrear	11	18	3	Travelling expenses	136 16 4		
Interest on caution-money	42	3	9	Salaries	200 0 0		
Sundry creditors (including contractor)	3,792	12	3	Directors remuneration	475 0 0		
Debentures, 250 of £100 each	25,000	0	0	Law charges	90 2 10		
				Printing and stationery	16 14 5		
				Rent of London office	37 10 0		
				Advertising	1 19 0		
				Interest on debentures	482 17 7		
				Audit	21 0 0		
				As per last balance-sheet	2,531 9 4		
				Plant and machinery — Expended for tools at Potsdam		369 15 6	
				Stores account—Pipes, &c., in store at Potsdam		395 7 11	
				Potsdam working expenses—			
				Wages, fuel, printing, stationery, lighting, &c.		175 19 11	
				As per last balance-sheet		123 7 10	
				Cash balances—			
				With bankers on current account		1,252 1 1	
				With manager at Potsdam		7 3 5	
				With secretary (petty cash)		1 13 11	
	£108,209	14	11			£108,209	14 11

Balance-Sheet, showing Receipts and Expenditure from July 1, 1875, *to June* 30, 1877.

Capital account—				Concession, as per last balance-sheet		£5,000	0 0
2688 shares of £20 each, which have been paid up in full		£53,760	0 0	Concession expenses, as per last balance-sheet		2,325	1 6
968 share warrants of £20 each	19,360	0	0	Construction of works—			
3656 shares of £20 each, on which has been paid	£73,120	0	0	As per last balance-sheet	94,499 15 6		
Amount retained from payments to contractor in respect of interest payable to shareholders, &c.	5,905	9	8	Half year ended June 30, 1877	2,573 13 5		
Interest—				Sundry expenditure—			
Received from bankers on deposit account	34	13	5	Miscellaneous expenses	6 13 11		
Interest on calls in arrear	11	18	3	Travelling expenses	50 0 0		
Interest on caution-money	59	1	3	Salaries	200 0 0		
Sundry creditors (including contractor)	7,276	10	4	Directors remuneration	475 0 0		
Debentures, 250 of £100 each	25,000	0	0	Law charges	22 6 2		
				Rent of London office	37 10 0		
				Advertising	4 16 0		
				Interest on debentures	510 0 0		
				As per last balance-sheet	4,059 8 4		
				Plant and machinery—			
				Expended for tools, &c., at Potsdam, as per last balance sheet		369 15 6	
				Half year ended June 30, 1877		63 16 2	
				Stores account—			
				Pipes, &c., in store at Potsdam, as per last balance-sheet	£395 7 11		
				Less value taken out of stores and charged to construction of works account	94 12 2		
						300 15 9	
				Potsdam working expenses—			
				Wages, fuel, printing, stationery, &c.		194 13 4	
				As per last balance-sheet (After crediting £148 6s. 4d., amount received for water to June 30, 1877.)		299 7 9	
				Cash balances—			
				With bankers on current account		409 8 2	
				With manager at Potsdam		5 11 5	
	£111,407	12	11			£111,407	12 11

The Chairman: Gentlemen, there are not many matters in the report which require any extended observations from myself; nevertheless, in this case, as in many others, there are certain points which demand some little attention, and which may probably require some explanations from me; and in the event of my overlooking any point, I have no doubt that our friends present will, by their questions, elicit such matters as I may accidentally pass over. It will have been seen from the report itself that within the limit given to the contractor, he was able to accomplish the erection of the works. There was one matter in relation to that which required and received on the part of your board a considerable amount of attention, because it caused some degree of anxiety. The liabilities of the contractor and the favour of the magistracy of Potsdam were so twisted and twined together that they could scarcely be separated, and your directors had great difficulty in receiving as complete the works of the contractor, until the magistracy had signalized their approval of the manner in which they had been executed. As to the quality of water supplied, in our case, as is often the case in a small community, you will find half a dozen recusants, who are enabled to set the whole of the community by the ears. We see that in the House of Commons at the present time, greatly to the discredit of those who might control it. But when we remove the venue to a place so many miles away, the probability is that when we have little control over the eccentricities of certain individuals, they may kick over the traces, and cause a considerable amount of annoyance. Some have demurred to the manner in which the works were completed, to the time in which they had to be finished, and also to the quality of the water, and they employed some second or third rate chemist to analyze it, and he disapproved of it. However, we felt it to be our duty to remove the question from local partisans, and local influence, and to call in the most distinguished analytical chemist that Germany possesses, Dr. Ziurek, of Berlin, who obtained from our works certain proportions of our water from several points of our supply, and took them to his laboratory, where he had them analyzed. He made a report, and I am glad to inform you that Dr. Ziurek's analysis was so complete and thorough as to send adrift all the folly and weakness that had been generated and circulated by the incompetency of the party asked to investigate the quality of the water. That being so, of course, the whole of the objections fall through. We are very glad to find in the report of our manager at Potsdam, that in the course of the next fortnight the official recognition not only of the completion of the works, but also of the excellency of the water supplied, will be given by the magistracy and authorities at Potsdam. It may be to the satisfaction of our friends who are not here present to know that all that was promised to us originally by the concessionaire, and in conformity with his opinion taken up by the board, has been carried out, and has been most completely confirmed by results. This alone might be almost sufficient to show what we have accomplished. The works having been completed at a very considerable expense, the question naturally arises to the shareholders, what proportion of the population of Potsdam have agreed to take the water? Of course, seeing that we only had the works certified as complete at the end of June, it is rather early for us to give any adequate report as to who are not only now willing, but who will ultimately take the water; but so far as the reports have come in, they are, to us, quite satisfactory. I dare say we have now, of the largest consumers in Potsdam—of those who are the wisest and most acute in regard to their own convenience—probably about 10 per cent. of the entire population have taken the water. But in new works like these it requires some time to imbue the population with the idea of the necessity of the one and the convenience of the other. It is a matter of time, and we must have patience; but so far as our experience goes at the present time, we see no reason to modify, to any extent, the first idea promulgated in the prospectus issued to those who ultimately became shareholders. We have this double satisfaction that, within the last two months, several large establishments connected with the Government have taken the water. With many others we are now in negotiation, and probably within the present month these arrangements may be carried out. Not only that, but we have now completed our line across the Havel. Of course, I am speaking in language not understood by many of our shareholders; but I may say the Havel runs along the edge of Potsdam the same as the Thames runs along the edge of the City of London. Across the Havel, what may be Southwark is represented by the area of a railway station and a number of large buildings. We have to-day had an application from the railway authorities as to the terms on which we will supply them with water, and, according to the scale suggested, we see no reason for doubting that we shall come to an agreement by which we will very nearly double the supply at present given to Potsdam. Altogether the matter is most satisfactory, and the small expense incurred in crossing the Havel, which was a part of the original contract, will be amply compensated by the railway consumption alone. Of course, there are other matters under our care which have caused a natural amount of anxiety. In consequence of its being the second or third month of independent action, we naturally feel that it will be absurd for us to give you an absolutely rosy account of the financial condition of the company. Suffice it to say all the works have been completed, and the material supplied is of undoubted quality. Now the question of finance is one which naturally interests all parties, and it is one in relation to which we ought to exercise the largest amount of care, consideration, and discretion. According to the first idea, and according to the contract to complete the works on certain terms and conditions, you will find the whole amount is some £94,000 or £95,000, to which were to be added some small expenses of several kinds. But these are matters of account, and being at the present time *sub judice*, I think it would be very imprudent for me now to refer to any question as between the contractor and the company. Many of those matters have to be reconsidered before we can come to a final estimate. This, however, I may say, that, up to the present time, the amount for which we had become liable is about £111,000, and I am happy to say the whole of that sum, within £7000 has been paid. I apprehend that there is scarcely a company of similar dimensions, commencing as we did at a time of considerable commercial distress and depression, and going through a period when all Europe has been excited, that can record so much success. Thanks to the assistance of several of our friends, who are potential in finance, or otherwise influential, the result is that the company have, at the present time, all their works completed, and have a liability of only a little over £7000. Such a state of matters is very creditable indeed to the direction, and certainly very creditable to the party from whom the first idea was derived. There is a matter that comes naturally before us, and one which must be looked at full in the face. It will be remembered by the shareholders that interest was to be guaranteed, during the construction of the works, at 6 per cent. per annum; and from six months after the certificate was issued that the works were complete, the company depend upon themselves for revenue; and I find that the interest on debentures, and the various other matters in connexion with the expenditure, will amount to over £3500. We shall require a considerable revenue to meet and cover the expenses. However, it is only fair I should say that, for the next three years, one-half of the interest on debentures, amounting to £8000, is guaranteed by the concessionaire, upon conditions agreed to by the directors some four or five months ago; therefore, the amount for the next three years will be diminished by about £500. Here, I think, I may almost stop, and ask you to vote the report and accounts which have been laid before you; but I think it would be incomplete if I did not state what has been under the consideration of the board for some time past. And although, as on most boards, almost all the present directors, with one or two exceptions, have been members from the beginning, doubtless they were induced to become members upon certain propositions laid before them. That is to say, that they should give their services to the best of their ability, and for such services they should receive an annual amount of remuneration. That has been carried out most faithfully up to the

present time; but your board now think it would be prudent in them to show to the shareholders that they are willing to make, for the present, at all events, a certain concession in regard to such unmistakeably legal claims. It is, therefore, proposed that the directors shall receive—and they are willing to accept—one-half their present remuneration in cash, and that the other half may be taken in shares, if they think fit, or the moiety may be held in abeyance, without interest, until such period as may be determined by the position of the company. That, I think, is a very graceful thing on the part of the board; and probably there are other expenses in connexion with the administration that may be looked at in the same manner, and if such suggestions are adopted I think it is likely that it will be for the benefit of the company, and all concerned in it. I mention this matter to you now because it is one for the shareholders to consider. As to officers and other *employés*, I think it will be right for the directors to make the best arrangements they can. I need hardly say that the secretary took office under certain conditions; and we must not forget that when he became our secretary he hoped the engagement might be considered a permanent one, so long as he agreed to keep the appointment at the moderate salary which, for a gentleman of his position, he was receiving; but there are times in companies when what would appear, from some points of view, to be a moderate salary, would be considered by some an excessive one—not for the services rendered, but for the position occupied. Those matters have to be considered, and probably that part of the question might very properly be left to the board. I think, gentlemen, I have touched upon the various points which ought properly to be brought before you. I hold it indispensable that all public companies should take their shareholders into confidence, leaving nothing unstated. As far as I know, I am not aware of anything I have not referred to. The probable result in the future I believe to be exceedingly hopeful, because day after day, and week after week, fresh consumers come in, and we depend entirely for revenue on the amount of water consumed. Everything looks exceedingly well, and we see no reason to doubt that the high expectations on the part of the directors will be ultimately realized. I have great pleasure in moving the adoption of the report which has been presented to you.

Mr. Tucker seconded the motion and in doing so expressed his belief in the future prosperity of the company.

Mr. Karuth wished to say a few words in explanation as to the opposition that the concessionaire had met with as to the quality of the water, and the time taken for the completion of the works. There was not exactly an Irish faction in the municipality, but there was a sort of Lower House, consisting of about 30 or 40 persons, corresponding to aldermen, and amongst these were several applicants for the concession. One of them was an alderman and a bank director, and leader of the democratic movement in Potsdam, who had a great many people at his back, and had been the means, by obstructive proceedings, of keeping this question like a football between the magistrates and the council of aldermen; but, on the 10th of the present month, the matter would be fully settled entirely in favour of the company, so that the obstruction that had made itself felt would be entirely done away with.

Mr. Harrington congratulated the board on the completion of the works. He was sure that every shareholder would feel doubly indebted to the directors for the admirable way in which, through the concessionaire and the contractor, the difficult work had been carried out. Not only had they been carried out with admirable engineering skill, but they had answered the practical want of Potsdam in the supply of pure water. He had heard the opinion of an eminent firm of English water-works contractors, that the works had been admirably carried out, and that in a short time they would be productive of a very fair *bonâ fide* return to the shareholders. Of course, the public of any city where such works were introduced had to be educated to the use of them. Although it was perfectly true that such works offered wonderfully health-giving facilities to the population, still the question of pounds, shillings, and pence came under consideration. The inhabitants had been accustomed to have their supply of water carried to their houses from the river Havel by their servants, and, as was pointed out at the last meeting, the best agents on behalf of the water company would be the servants themselves, who, when they found that the neighbouring servants did not bring the water up, would perhaps strike or strongly expostulate with their employers, and ask them to have their supply through the company, and so save them much manual labour. He agreed with the remarks of the chairman as to reducing the fees of the directors, who at the present time had to face the difficulty of reducing the administrative expenses down to the last possible point consistent with efficiency. Such action on the part of the directors furnished a guarantee that they intended to carry out the system of economy in administration to the utmost possible point. He hoped that while the directors did not fail to look to the administrative expenses of the company, they would also look to the expenses incurred at Potsdam, although it was not a question of expenditure of hard cash; they might lose a considerable income by the neglect of those precautions which every well-managed water company ought to adopt. He thanked the directors on bahalf of the shareholders for the way in which they had managed the financial part of the business, and concluded by supporting the motion for the adoption of the report and balance-sheet.

In reply to Mr. Watts, the Chairman said he could not give an estimate of the supply of water for the current year, because it was only wanted from time to time. In July of last year the company were prepared to supply all who demanded water; but the summer being ended, householders thought they could dispense with the supply of water for their gardens, and they felt they might probably save some money by not requiring the water to be laid on then, and to wait until the spring time. The company had had a tremendously heavy task in that locality, as the snow lasted for a long time. At the end of September the frost began, and hindered the work, and it continued to the end of March of the present year. That prevented the application of a considerable number of consumers; but since then the supply had been going on steadily until the end of June, when the return was made, and you will note that all receipts on revenue account to the end of June have been placed to the construction account. Under those circumstances, it would be unfair to estimate the value of the supply. There were certain people who were wise enough to bespeak a supply of water several months before the company were able to supply them; then came the period of hesitancy, and misreports from interested parties were made in regard to the condition of the works and the quality of the water. All this being set aside, the company were preparing for that tremendous rush to which he had referred, and the probability was that before the end of the year they would be almost unable to supply the demands; but until the end of the year, it would be undesirable for him to give an estimate of the number of applicants. He might, however, state that they had about 200 of the largest consumers of water in the city of Potsdam, and this would represent probably in the aggregate amount of water consumed one-fourth of the whole number. He did not want to depend too much upon that, for fear he should be pulled up on the matter 12 months hence. He believed, however, that before the end of the first year's working there would be ample ground for satisfaction, that the whole affair had been completed in a most admirable manner, and that the directors were in a position to carry out all that they had hitherto promised. With reference to the question of economy referred to by Mr. Harrington, he might state that 12 months ago, when a deputation was over at Potsdam, to open the works, the future management of the concern was under serious consideration. It could be readily understood that such important works required a superintendent, if he could be secured, who was acquainted with engineering, and who had a certain amount of hydrostatic skill. A gentleman of the highest possible qualifications applied for the situation, but the cost of his services was such that, as soon as the directors estimated his services, and the probable remuneration he should demand, they determined to look elsewhere. The result had been that the expenditure at Potsdam had been cut down to one-half of what at one time had been expected it would be. He was happy to say that instead of suffering any disadvantage from the change that had been made, a large amount of credit had been obtained, not only in this country, but at Potsdam. He concluded by paying a high tribute to the tact and administrative ability of the manager.

Mr. Karuth asked if any communication had been received from the manager in Potsdam in reference to the supply to the military authorities.

The Chairman said that there had been an intimation to that effect, the particulars of which had not been received. He was happy to say that a scale of tariff had been arranged so as to meet the wants alike of the smallest and the largest consumers, giving to every one of them a certain quantity of water every quarter, a certain rebate in price being proportionably made to the largest consumers. What they had done had been merely in the form of suggestions, and laid before the manager, with a view of his bringing them before the authorities, and those who were interested, in order to ascertain whether the concession made to large consumers, would be objected to by the smaller consumers. He was happy to state it was considered a most equitable one, and, in the case of the larger consumers, the scale would be then under a contract. It was very likely that before the meeting of the board ten days hence these matters would be fully confirmed.

Mr. Tucker said that Mr. Harrington seemed to think the business of the board was now *nil*. He rather thought that they were now engaged in the most anxious part of the business of the company. They had gone through certain degrees of anxiety, and they had now to look to the future, which would require as much care as had been exercised in the past.

The motion for the adoption of the report was then put and carried unanimously.

The Chairman said that the next proposition was that in future the annual general meeting be held early in the month of February. By a resolution passed last year, the official accounts were closed at the end of the year, but by an oversight, or by an arrangement made primarily which was not altered, the annual meeting was held in July. It was therefore proposed that the two should harmonize, and that the annual meeting should be held in February instead of July, so that the directors might be able to present, not only the report and accounts, but also to re-elect all the various officers of the company at the same time. This would be much more convenient, because there would be one meeting instead of two. The result would be that the next annual meeting—if he might use an Irishism—would be held six months hence. This they were advised by their solicitor was entirely under the control of the board, and did not require any special resolution.

The retiring directors and auditor were re-elected.

A vote of thanks to the chairman and directors was passed by acclamation.

The Chairman, in returning thanks, referred to the unanimity which pervaded the whole of the members of the board and the officers, both in this country and in Germany, which, he said, augured well for the future prosperity of the company.

The proceedings then terminated.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

(*Continued from page* 185.)

Mr. W. Young (Clippens) read the following paper on

THE CAUSES AFFECTING THE QUANTITY OF CARBON DEPOSITED IN RETORTS.

In the discussion which followed the reading of Mr. Kay's paper, at our last meeting held in Edinburgh, I took the liberty of blaming the gas fraternity with being rather too imitative in their propensities—rather over much inclined to take what is told them for granted, and with doing what others had done before them, without knowing the reason why such and such things were done in such a way, and with believing that such and such effects were the results of certain conditions of things, without making efforts to test the truth for themselves.

I had and have no desire that it should be inferred from those remarks that I do not fully appreciate the value of practical experience, and the great advantages to be gained by receiving and acting upon the ideas and suggestions of others. For such purposes were this and kindred associations created, that we might communicate our ideas and our experiences to one another for our mutual benefit. But what I wished to be inferred was, that we did not sufficiently sift and investigate into the truth of statements made to us, to prove, or at least ascertain for ourselves, whether the results stated as obtained were explainable by the laws and principles on which our manufactures are based; and that, by adopting the suggestions of others without this sifting process, we simply became imitative animals. Partly to make atonement for, and partly to justify, these assertions, I have prepared this paper on the subject of carbon deposit.

The manufacturer of paraffin oil, in distilling his shale and coal, employs an exhauster to draw off the vaporous products from the retorts, with the view of increasing the yield of liquid hydrocarbonaceous products by preventing their formation into permanent gases. On the other hand, the gas manufacturer employs an exhauster to exhaust the products from his retorts, and states that, by so doing, he increases the yield and quality of the gas, and prevents the formation, or, in other words, reduces the yield of the liquid hydrocarbonaceous products. Again, the gas manufacturer urges the heat of his retorts almost to the melting-point; not only so, but not even satisfied with the mere surface of the retort to bring about sufficient decomposition of the elements of the coal into illuminating gas, some have employed highly-heated solid substances through which to pass the products of distillation, in order to bring about a still further decomposition, and yet, at the same time, employ exhausters with the view of drawing off the gases and preventing decomposition—the very thing they are trying to bring about! And again, we are told that the exhausting or the lessening of the pressure of the gases in the retort prevents the deposit of solid carbon, or, in other words, that the deposit of carbon on the surface of gas-retorts is undoubtedly caused by the compression of the gases in the retort immediately after their formation; and further, that it follows that, from the lesser formation of carbon on the interior surface of retorts, there is, upon an average of cases, 10 per cent. more gas made per ton of coal distilled. On the other hand, we are told that the greater the amount of solid carbon deposited in the destructive distillation of an organic substance, such as coal, the greater will be the volume of gas produced.

Now, gentlemen, it is evident that under like conditions it is impossible that all these statements can be true, and yet at the present moment, so far as I can learn, they are all either more or less acted upon and accepted as facts by many who by a little investigation would be satisfied that in many cases they are quite untrue, and in others inapplicable to the materials and to the conditions under which these materials are employed in their respective works. It is obviously impossible, in the limits of a paper such as this, to take notice of, and fully or anything like fully to discuss all these statements; and I, therefore, propose, in my remarks to-day, to confine myself more particularly to the assertions anent the causes of carbon deposit in the internal surface of retorts, and the results arising from its prevention.

When any given coal is subjected to carbonization or destructive distillation at two very different temperatures, the one being as low as possible, and the other at the temperature ordinarily employed in the manufacture of gas, it is found that at the low temperature the volatile hydrocarbonaceous portion, gas and oil, contains a much larger quantity of volatile carbon than is contained in the gases and oils or tars resulting from the distillation at the ordinary gas-making temperature. And further, it is found that the higher the temperature and the greater the volume of gas produced, the lower is the quantity of volatile carbon contained in the volatile tars and gases.

This points conclusively to the fact that in the process of carbonization of a coal for the manufacture of illuminating gas, as at present conducted, carbon is necessarily deposited; and further, seeing that the heat necessary for the decomposition of the constituents of coal, and their formation into permanently illuminating gas, and other hydrocarbons, cannot be applied all at the same instant of time, the process of carbonization is necessarily of a fractional character—*i.e.*, the constituents of the coal are by the first application of heat torn asunder, and converted from the solid into the liquid state. By a further increment or absorption of heat these liquids are converted into vapours and gases, which are in turn further torn asunder, by the action of higher temperatures, into simpler compounds; at all those stages carbon in the solid form being more or less eliminated, and the liquids and gases becoming simpler in their constitution.

Heat, then, being the force which tears asunder the elements of coal, and re-arranges them in the form of the various products, must, therefore, also be the sole cause of carbon being deposited; but, as we all know, it very much depends upon how the force of the heat is applied to the wrenching or tearing asunder, and the re-arranging of the elements in the coal, what the nature of the resulting products will be, and where and when the necessarily liberated solid carbon atoms are deposited.

If the vapours of crude paraffin oil (which are essentially identical with those liberated from the coal during the first stage of the distillation for gas) be passed somewhat slowly through an empty retort or tube of considerable diameter, having a smooth internal surface, and heated to bright redness, only a very trifling amount of the vapours are decomposed, and the oil vapours pass almost unchanged, decomposition taking place principally where the vapours come into direct contact with the surface of the heated tube, and there for the most part is carbon deposited. If, on the other hand, the tube be now filled with some solid substance, such as pumice-stone or coke, presenting a large surface, and if the oil vapours be passed through it at the same rate, the decomposition is very much increased, and only a very small quantity of the vapours escape decomposition, and the solid particles of liberated carbon being principally deposited upon the highly-heated surface of the tube and its solid contents; and if the process be continued for some time, the interstices between the solid substances become completely choked up. Indeed, this is one of the practical difficulties experienced in decomposing the vapours of oil into gases, and also in employing highly-heated substances to decompose the products of the distillation of coal in the manufacture of gas, necessitating that the solid matter be frequently stirred in order to open up new interstices.

If the oil vapours be passed a little more quickly through the heated tube, the loose, flocky carbon, at the moment of its liberation, is partly impacted or rubbed into, and forms a hard skin or surface. The loose particles of carbon or soot not so impacted are carried forward with the current of gases and partly undecomposed vapours, which, if not abundant, are rendered thus pitchy, and cause them to deposit in the outlet-pipes; and, as we all know from disagreeable experience, chokes up the stand-pipes. If, on the other hand, the vapours are abundant, they carry forward the soot or carbon particles till they are condensed, when the whole is deposited together in the condensers as thick black tar.

This effect of surface, in bringing about decomposition, results partly from the fact that gases and vapours are comparatively feeble conductors of heat. They allow the heat-rays or pulsations sent into them from the heated walls of the retort to pass freely through them without being themselves heated to that extent necessary to bring about decomposition, and therefore it is only by direct contact that the necessary amount of heat can be communicated rapidly in order to bring about the decomposition of an organic substance when in the vaporous state. Further, we have evidence that surface has a catalytic effect in bringing about decomposition or chemical change, as, for instance, the effect of heated surfaces in bringing about the decomposition of bisulphate of carbon in coal gas, and its conversion into deposited carbon and sulphuretted hydrogen, the oxidation of hydrogen when brought into contact with the surface of platinum black in the atmosphere, &c.

Seeing, then, that surface is, so to speak, the medium through which the heat is transmitted to the elements of coal to bring about decomposition, it is evident that any condition or arrangement connected with the manufacturing plant which increases the amount of surface, or the contact of the vapours with the surface during the process of carbonization will bring about an extra amount of decomposition, and, consequently, an extra deposit of carbon on the surface, so bringing about that decomposition.

As you are aware, there are various conditions which more or less affect the amount of surface in the practical manufacture of gas. First, the nature of the coal employed affects this to a very considerable extent; with caking coal the whole charge softens into a pasty mass, which becomes rapidly deprived of its volatile matter where it is in direct contact with the retort, and where it is exposed to the heat radiated from the roof of the retort, this carbonized external portion, being hard and rigid, is cracked and burst into fissures by the escaping gases and vapours from the centre of the charge, as well as by the external shrinkage of the coke; and as this external crust is also a very bad conductor of heat, the process of distillation is a slow one, and the escaping vapours and gases are necessarily exposed to a large surface—first in passing slowly through fissures in the external crust of the coke, and again in being repeatedly exposed, by circulating in the free space above the charge, to the heated surface of the retort. In short, the distillation of a caking coal is necessarily affected by the heat conducted to it through the char or coke, whereas, where a non-caking coal, such as our Scotch splints, parrots, and shales, is employed, which do not soften and become pasty, but remain loose and open, the carbonization is effected not only by contact or conduction, but also by convexion, in consequence of the heated gases and vapours passing freely through the interstices or spaces between the individual pieces of coal. The distillation is therefore effected much more rapidly, and the gases and vapours are exposed for a much shorter space of time, and to a comparatively smaller highly-heated surface. This difference in the rate of distillation between a caking and a non-caking coal might, perhaps, account for the great favour for exhausters in England, as compared with Scotland; because it is evident that, the more difficult it is to carbonize a coal, the more rapidly should the gases, as soon as liberated, be removed from the necessarily intensely heated retort; and, on the other hand, when the coal is easily and quickly carbonized, and contains a large quantity of volatile matter, a greater amount of heated surface may be employed with advantage, and the gases may be left a little longer in the retort without injury.

We are all also conversant with the advantage of keeping the internal surface of the retort smooth, for by so doing the actual surface is reduced by removing excrescences which, in many cases, very much increase the superficial area of the retort. Then again, it is evident that if the gases and vapours are compressed to any considerable extent during the process of carbonization, the decomposition will be increased, for in proportion to the amount of compression will be the number of molecules of gas and vapour which are brought into contact with a given amount of surface. Mr. Grafton, who introduced the use of exhausters in the manufacture of illuminating gas, lays very great stress upon the effects of pressure in bringing about decomposition of the gases inside the retort. I have no doubt that most of you are conversant with the nature of the experiments made by Mr. Grafton, which satisfied him that pressure was the cause of carbon being deposited; but to those who are not, I may be permitted to explain that they consisted essentially of carbonizing coal at similar temperatures, but under different pressures. When he increased the pressure on the charge equal to a column of water 14 inches high, he found that in the course of a week carbon had been deposited to the thickness of about an inch, and that, when once formed, it accumulated more rapidly, till the whole inner surface to within a foot of the mouth was covered with it. At the further end it rapidly filled up the retort, preserving an equal thickness, until at the expiration of two months it had reached 24 inches in thickness, and when cut out of the retort and weighed it was found to equal $1\frac{5}{10}$ per cent. of the total weight of the coal from which it had been derived.

From the results of those experiments, Mr. Grafton inferred that the $1\frac{1}{10}$ per cent. of deposited carbon was undoubtedly due to the compression of the gases in the retort immediately after their formation. That Mr. Grafton got the results he asserts I have not the smallest cause to doubt; but from experiments which I have lately made, I do not believe that he was right in his deductions from those results, for I am satisfied that the mere compression of the gas is not capable of producing such a difference in the amount of carbon deposit. The greatest pressure employed by Mr. Grafton in his experiments, to compress the gases as they were produced, was equal to a column of water 14 inches high, above that of the atmospheric pressure surrounding the retort. This would compress the gases to the extent of scarcely 3 per cent., or every 100 molecules of gas contained in the retort would be compressed or reduced in volume to occupy the space of about 97 molecules. Therefore, a heated surface which would have been sufficient to decompose 100 molecules of gas when no pressure over that of the atmosphere was exerted, would be under the increase of pressure equal to a column of water 14 inches high, able to decompose about 103 molecules. Therefore, so far as pressure, *per se*, on the gases is concerned, there should only have been an increased deposit of carbon to the extent of 3 per cent. Further, as shown some time ago by Mr. Dunlop, the compression of the gases during the process of distillation is far more dependent upon the pressure of the atmosphere than upon the action of the exhauster, for all that is attempted to be done by using the exhauster is to keep the pressure on the gases in the retort equal to the external pressure of the atmosphere surrounding the retort. It is, therefore, evident that, as the external atmospheric pressure changes from day to day, then, if the internal pressure be kept at level gauge, it must, of necessity, alter also; and, consequently, if the act of compression of the gases in the retort were the cause of carbon being deposited, changes of barometrical pressure should affect the amount of carbon being deposited; and I have no doubt that it does so, but only to the comparatively trifling extent indicated.

There is, however, another and far more potent manner in which the excess of pressure, equal to 14 inches of water on the gases inside the retort, over the external atmospheric pressure, affects the gases—viz., by causing them to leak or transpire through the walls of the retort; and, to my mind, this, so far as the influence of exhaustion is concerned, is the only great advantage to be gained by its employment. But even this leakage does not account for the results obtained by Mr. Grafton; for, in order to bring about the deposit of $1\frac{5}{10}$ per cent. from the coal, it would be necessary that about 1400 cubic feet of gas per ton of coal carbonized should be pressed through the walls of the retort, and be completely decomposed into pure hydrogen before sufficient carbon could be deposited, in order to make up the amount stated. Although there is no doubt a certain amount of leakage through the walls of the retort, yet I do not think the most sanguine advocate of exhaustion will assert that there passes in this manner 1400 cubic feet of gas for every ton of coal distilled; and, at any rate, it is quite evident that Mr. Grafton did not think that the pressure on the gases produced the deposit of carbon, by causing them to transpire or leak through the walls of the retort, for he points out that the carbon accumulated faster as the deposit got thicker, and, consequently, less pervious to the compressed gases.

Our esteemed member, Mr. Boyd, of Alloa, who, as you all know, has devoted a large amount of careful study to the cause and prevention of carbon deposit, and who is, therefore, very competent to give an opinion upon the matter, stated, during a conversation we had some two years ago, that he had come to the conclusion that pressure upon the charge undergoing carbonization was not the major cause of carbon being deposited, and that exhaustion was comparatively powerless in preventing carbon from being deposited—that he had observed that it was far more affected by the amount of dip in the hydraulic, and the relative fluidity of the liquid into which the pipes dipped, than by anything else—that by increasing the amount of dip or seal on the hydraulic he invariably had an increased deposit of carbon, whether he increased the rate of exhaustion to counterbalance the extra dip or not. He could not give me any feasible reason why pressure brought on to the charge by an increase of the dip in the hydraulic should not act in a similar manner to pressure produced by any other means; but, nevertheless, he stated it as a fact for which he could vouch.

This statement of Mr. Boyd's set me a-thinking, and I have since given the matter a good deal of consideration, and I am now satisfied that Mr. Boyd is to a great extent correct in his assertions. You will observe that both Mr. Grafton and Mr. Boyd agree as to the results under like conditions; for it is more than likely that Mr. Grafton increased his pressure by means of a water-seal or dip, the only difference between them being the inference drawn from the results; the one attributing the carbon deposit solely to the compression of the gases, and the other, not to compression, but to some other effect produced on the gases by means of the seal.

As I have already indicated, I have given the matter some thought, and

I will explain to what I consider the excessive deposit is due. I have here a Woulfe's bottle, containing a little granulated zinc and water, and floating on the top of the water is a little volatile hydrocarbon. Issuing from one of the two necks of the Woulfe's bottle, as you see, is a tube having a small cock-spur jet fixed into it, and from the other this pipe leading to and dipping into the water in this tall glass. We shall suppose the Woulfe's bottle to represent the retort, and the pipe leading and dipping into the water to represent the stand-pipe and hydraulic. On adding a little hydrochloric acid to the zinc contained in the Woulfe's bottle, it is decomposed, and hydrogen gas set free, which, passing through the volatile hydrocarbon fluid floating on the surface of the water, becomes carburetted, and on applying a light, we have this very luminous flame at the cock-spur jet. Now, gentlemen, what I want you to observe is, that at each bubble of the gas, as it escapes from the sealed outlet-pipe, the flame is alternately enlarged and diminished. This is seen more clearly when I enlarge the dip-pipe with this open inverted funnel. You observe how at each escape the gas is violently pulsated, and the light bobs up and down. By increasing the make of gas by adding a large quantity of acid, the gas escapes more rapidly, and the pulsations succeed each other at such a rate that the whole gas inside the Woulfe's bottle is violently pulsated. A very crude, yet very convincing, mode of making this experiment is to blow with the mouth through a piece of ordinary three-quarter inch gas-pipe into water, when the pulsatory action of the intermittent escape of the breath is sensibly felt on the walls of the mouth cavity.

The reason why these pulsations take place is, that the gases being elastic are more and more compressed as they accumulate, and depress the water further and further till such time as they overcome the whole dip, when the water is for an instant displaced around the seal, and the gas rushes violently out till its elasticity is relieved, when the water again flows back. The gases again become compressed, till they again overcome the whole dip, and this action is just repeated time after time. Now, as I have already said, contact between the gases and the heated surface of the retort and its contents is the principal cause bringing about decomposition of the gas and vapour inside the retort, and, seeing that the effect of the seal is to cause the gases and vapours, from their elastic nature, to pulsate violently backwards and forwards along the roof and sides of the retort, it is evident that the gases and vapours travelling along the roof of the retort will be caused by this pulsatory action to travel again and again over the same surface, and thereby made to undergo repeated decompositions, and, consequently, an extra amount of carbon must be deposited.

To test the truth of this mode of reasoning, I had my experimental retorts so arranged, that by means of a piston acting in the one end of the retort, I could intensify the pulsatory action of the gases. I further so deposited the coal in the retort, that at the centre of the charge there was only a narrow space left between it and the roof of the retort, and, consequently, the rubbing action would be intensified at that point. On removing the door from the retort after the first charge had been carbonized, it was found that a very considerable deposit of carbon had taken place over the roof the retort, but much greater where the rubbing action of the pulsations had been intensified opposite the part contracted by the charge; and after six charges there was a deposit of carbon produced at that place fully three-quarters of an inch thick.

On charging in the same manner, but avoiding all pulsation of the gases in the retort, after six charges had been worked off, the deposit of carbon was so small as to be scarcely noticeable. In making both experiments, care was taken to have the mean pressure the same in both cases.

I think that these experiments prove pretty conclusively that Mr. Boyd was not far wrong in his deductions from the results—viz., that excessive deposition of carbon is due in only a minor degree to the mere compression of the gases inside the retorts, but in a major degree from sudden changes of pressure caused by the dip in the hydraulic.

There can be no doubt that the deposit of carbon on the retorts is a great nuisance, and I am satisfied that it is a source of loss in reducing the illuminating power when caking coal is used and high heats worked; but I am not of the same opinion when cannel and shales are employed at like heats, or when a caking coal is distilled at slightly lower heats; for, from experiments which I have made lately, with the view of testing the accuracy of my surmises as to the pulsatory action in bringing about deposition of carbon, I am satisfied that a violent aggregation of the gases and vapours inside the retort may be used with great advantage, both in bringing about a more rapid and a better regulation of the decomposition of the elements of the coal into illuminating gas. My experiments on this matter are not yet sufficiently complete to allow me to give at present a more definite opinion on the matter; but I hope at some of our future meetings to have the pleasure of entering more fully into the subject.

Before closing this paper, I have only a few remarks to make anent the oft-repeated assertion that in consequence of using an exhauster, and thereby preventing carbon being deposited, there is produced 10 per cent. more gas per ton of coal. If those who put forward this assertion would inversely assert that those not using an exhauster are pressing through the walls of their retorts a little more than 10 per cent. of the whole quantity of gas which they are making, their statements would, in my mind, be in perfect harmony; but I have never met such. I have met many who admit they do not get any such increased production of gas; but, on the other hand, I have met with an equal number who assert that they get even more than 10 per cent. increased production. They cannot account for the extra yield, except from some (to them) mysterious action of the exhauster, whereby carbon is prevented from being deposited to the same extent, and the yield of gas increased.

To reconcile these assertions, and bring them into harmony with the physical and chemical laws which regulate the manufacture of gas, it is, in my opinion, absolutely necessary that the increased yield of gas said to be obtained must either leak outwards when an exhauster is not employed or leak inwards when it is, or partly both; for, so far as the rarifying action of the exhauster is concerned, less gas should be produced, from the fact that a lessened decomposition of the elements of the coal is brought about, for I have already pointed out that by our present mode of carbonizing coal it is essential that carbon be deposited to convert the volatile products into permanently gaseous compounds, and that the greater the amount of carbon deposited the larger is the volume of gas produced. If, then, carbon is not deposited, and yet the gas is increased in volume, then, all other conditions being the same, it is evident that it must be produced from some other source than the decomposition of the volatile hydrocarbonaceous matter distilled from the coal.

I dare say most of you are conversant with the laws relating to the diffusion and transpiration of gases, and how they act through pervious septa—how that, when the pores have a certain area in proportion to the thickness of the wall of the vessel containing a hydrocarbonaceous gas, it depends upon the amount of pressure exerted by the gases inside the vessel over that of the atmosphere whether transpiration or diffusion preponderates. When the difference in pressure is great, the outward transpiration of the hydrocarbonaceous gases alone takes place; but, on the other hand, gradually as the difference in pressure is reduced, transpiration becomes smaller and smaller, and the diffusive action of the gases gains the ascendancy, till, when the pressures both on the outside and the inside of the walls of the containing vessel are alike, transpiration ceases and diffusion alone takes place, the gases inside passing outwards, and the gases outside passing inwards, at rates in proportion to the square root of their density. On the other hand, should the pressure inside the containing vessel be less than the external atmosphere, the air will transpire inwards, and more or less arrest the action of diffusion, in proportion to the difference in pressure, till it totally overcomes it. Now, may the difference in the yield and the lessened deposit of carbon not be due to the action of the exhauster bringing into play the law of diffusion, and perhaps also, in some cases, transpiration of the atmosphere into the retort? If such be the case, the results are at once explainable; the oxygen of the diffused or transpired air would burn off the carbon, as it was deposited, and form, in all likelihood, carbonic oxide gas, and thus both the carbon would be removed and the yield of gas increased.

I do not wish to be understood that I make the assertion that such are the results where an exhauster is properly applied; because then the amount of exhaustion—or, more properly speaking, the pressure on the gases inside the retort—will only be reduced to such an extent as to prevent transpiration, and, at the same time, also prevent the diffusion of the atmosphere into the retort. What that pressure may be, I am not in a position to say; but I am satisfied that, in many places, the exhauster is employed to such an extent as to lower the pressure below what it should be, and that the changes to which I allude are thus brought about.

There are many other points connected with the deposition of carbon, and its relation to the production of illuminating gas, which it might be of interest to enter upon, but already this paper has extended too long. Suffice it to say, I hope that what has been said may produce discussion, and perhaps also induce members of this Association to investigate matters a little more closely before accepting them.

In conclusion, I wish to state the objects of my remarks to-day are, by the discussion which they may provoke, to direct attention to the desirability or otherwise of adopting means of removing pressure from the retorts during the process of carbonization, and, in this connexion, more particularly to the advisability of adopting pressure-removing arrangements in works which, under ordinary circumstances, do not require to carbonize the coal at a greater pressure than from 6 to 8 inches; and, further, whether the same conditions and arrangements of a work are suitable alike for the carbonization of a poor caking coal and of a rich cannel.

Mr. Reid: I venture to say that the theory Mr. Young has suggested for the deposition of carbon on the retorts is, to my mind, new, original, and ingenious. I feel very much disposed to attribute the deposition to the oscillatory action which goes on in the retorts. I have never been able to see the advantages of reducing the dip, but if that bubble action produces a pulsation inside the retort, that has the effect of bringing new particles of the gaseous fluid in contact with the heated surface. I am very much disposed to coincide with Mr. Young in his view. I do not know how far it can be practically used, but I am much pleased to hear Mr. Young announce this theory as to the real cause of the deposition of carbon in the retorts. My own experience has led me to doubt greatly whether the deposition was due to the dip being half an inch or 2 inches, or the resisting pressure 5 inches, but this pulsating theory seems to me to explain very much that has hitherto been inexplicable.

Mr. Peebles: I think that this theory opens up a nice field in connexion with the transmission of pulsations. I should like to inquire if any manager has put a pressure-gauge on the mouth of his retort. We all know that the deposition of carbon is a capricious thing; it is not always the coals that can account for it, and this theory may, to a certain extent, solve the problem. I know that when the hydraulic main is placed a long way from the retort, the managers have not been troubled with carbon, while in other cases there has been carbon in abundance. Has Mr. Young not given some solution of these mysteries? If it can be possible to introduce a pipe at the back of the retort, and take it away and attach a pressure-gauge, we know that the greatest deposit takes place at the back, and there the pulsation is likely to be strongest. If we knew whether the pulsation was greatest there or at the mouth of the retort, it would go some way to prove the truth of this theory.

Mr. Boyd (Alloa): In making these experiments I could not say what was the actual cause of the deposition of carbon. I considered it was between the dip and the retort. I found that whatever back pressure there was it made no difference; it was the seal. I reduced the seal and put on a hood, and carried the tar away to a lower level than the dip-pipe, and the carbon almost entirely disappeared. My idea was that if I could carry the carbon along with the gas, the gas would be all the better for it.

Mr. Munro (Alloa): We had three retorts taken out about two months ago, which had been going for three years, and they were as clean as the day they were put in, while the other nine going beside them contained large deposits of carbon.

Mr. Reid: I should like to know where these retorts are to be got.

Mr. Munro: They were got from the Clackmannan Brick-Works, and the others were by different makers.

Mr. Robb: I bored the lid of a retort and inserted a pressure-gauge, expecting that the pressure would be very great, but I found the pulsation at the beginning and end very small, and in the middle of the charge it was about half an inch. The length of the pipe connecting the hydraulic main with the retort was 20 feet. I have three retorts which I left half taken out; they were quite clean, and they have served four years. They are cracked, but I have mended many a worse, and obtained good results. Mr. Grieve, of Baukpark, made them.

Mr. Smith: You must have been working your retorts at low heats.

Mr. Robb: At the highest heat possible, with a charge of 2 cwt. The retorts are 7 feet 6 inches long and 13½ inches inside diameter, the average quantity of gas made being 34,000 feet per 24 hours.

Mr. Reid: I do not think this has anything to do with the question before us. It is my impression that, however small these pulsations are, they will be felt throughout the body of gas in the retort. It does not matter much for the length of the pipe; the amount of carbon we have is due to the oscillation caused by the dip acting in the whole of the retort. My opinion is that, if these pulsations are rapid, they will have the effect of increasing the contacts of the gas with the retort.

Mr. Boyd: I have used the same retorts as Mr. Munro, and found them to differ nothing from the others. I have also had the hydraulic main outside, and found a great deal of carbon in the retort.

Mr. Peebles: I believe, if there was a continuous stream of gas flowing through a pipe, these pulsations would be carried forward; but I do not believe they could be carried to the back end of the retort, and have the same intensity as at the mouth. I believe the further the hydraulic main is removed from the retort, the less will be the pulsation at the mouth of the retort.

Mr. Whimster: I was very much struck by the suggestion of Mr. Peebles, that the distance from the cause of the oscillation had a great deal to do with the pulsation in the retort. I agree with him, and experience proves, that the farther the dip in the hydraulic main is from the retort, the less the deposit of carbon will be. I think the pulsation has a great deal to do with the accumulation of carbon. As to this being greater at the back end of the retort, it is accounted for by the fact that our raking never reaches the back, whereas in the front, the carbon is very

often scraped off. I can throw off our engine, and make repairs in it and the boiler, without any trouble; and I find that during the six weeks I can do so, the accumulation of carbon upon our retorts is enormous compared with what it is during the use of the exhauster. I also find that the loss of gas is very considerable. Some years ago when putting up a new bed of retorts, I found that one end of the retort-house had sunk down about six inches, owing to the nature of the foundation; and one thing that called my attention to that was the accumulation of carbon at that point. That shows that, independent of pulsation, or with it, pressure has certainly a great deal to do with the accumulation of carbon. When a new retort-house was erected at Galashiels, I was told by the manager that he was keeping his ascension-pipes, which were higher than usual, free from tar, and he attributed this to their distance from the retorts. By removing the dip far from the retort, you have a real benefit, both in the deposition and accumulation of carbon, and the collecting of tar in the ascension-pipe. We all know that the wave must cease at some point, and the farther away it is from the cause, the feebler it is, and although felt at the mouth of the retort, it may not be so at the back.

Mr. HALL: I think I can answer one question—namely, that about removing the seal of the dip. I fitted up three of Copp's dip-relievers, and fitted a pressure-gauge on the mouth of the retort. The regular dip in my hydraulic main does not exceed an inch, and the regular pulsation was considerably above half an inch. On the removal of the dip and the seal, it struck me that, although the pulsations were limited, they were not entirely removed by this means. I had an ascension-pipe of considerable height—9 feet from the retort mouth. With regard to the deposition of carbon, I had six retorts all going at one time—three fitted up with Copp's dip-relievers, and three not—and I worked them side by side, and now I cannot say which is cleanest of carbon. There is, no doubt, the carbon is harder in the retorts fitted with Copp's apparatus than in the others. I am always glad when I can work the retorts two winters and a summer.

Mr. DICK (Kincardine): I was induced to try Copp's relievers, but I found I had as much deposition of carbon as ever, keeping the seal at the lowest, and the back pressure fully as light as before.

Mr. REID: We know from our unhappy experience, when a small bubble of water gets into the leading main from a meter, how unmistakably it makes every light vibrate, and the pulsation will in the same way affect every point of the area of the retort, and it is only a question of the volume of the wave that is produced in the pipe, to what extent it will be distributed over the surface of the retort.

Mr. YOUNG: If Mr. Peebles's theory held good as to the transmission of pulsations, I am of opinion it would to a large extent abolish the value of his beautiful arrangement for transmitting flash-signals through a long length of tube, such as he proposes to apply at railway stations, &c.; but that it does not; I have only to remind Mr. Peebles of the illustration he gave us at the West of Scotland meeting of gas managers at Linlithgow, as to the velocity of the transmission of a pulsation of gas through the mains in Leith, as proved by Mr. Reid arranging with the man in charge of the governor at the works to alter the pressure at a given time. Mr. Reid observed that almost at the very instant agreed upon the pulsation of altered pressure was indicated at his own house, a very considerable distance away. I have not the least doubt that the pulsation produced by the action of the dip in the hydraulic will follow the same law as sound. In fact, what is sound, but simply the mechanical effect of the vibrations of something, such as a bell, communicating to the surrounding atmosphere a series of pulsations? These pulsations emanate in all directions when in free space, and gradually spend themselves; but when confined in a tube, such as is the case of a speaking-tube, they are prevented from spreading, being reflected by the smooth sides, and sent along the tube. Sudden bends tend to deaden sound by the pulsations of the air spending themselves at such points; hence the reason, when laying such speaking-tubes, soft and easily curved bends are made. The pulsations from the hydraulic will die out in the same manner if the gases meet with sharp turns, and other interruptions which will counteract the pulsations. With reference to the amount of pulsation, and its relative effect in producing a deposit of carbon, I am at one with Mr. Reid in believing that it is not necessary they should be large, provided they follow each other in rapid succession; they will have the effect of producing an increased decomposition, and consequent deposit of carbon. Indeed, the laws relating to light, heat, &c., are based on the belief that the effects produced are brought about by a very rapid succession of infinitesimal pulsations. I am perfectly satisfied that the views I have stated are based on fact, and more or less produce the results indicated, and I am very much pleased that the few remarks I have made have brought about this discussion. Mr. Peebles expresses some doubt as to the pulsation being carried to the back end of the retort. If, as I suppose, the pulsation follow the same law as sound—that when we set a column of air in pulsatory motion it goes on pulsating till it meets with some impediment against which it expends itself. I am of opinion that the pulsations will pass backwards and partly expend themselves at the further end of the retort. And I am satisfied that the more we inquire into this subject the more rapid strides will we make as to the true cause of carbon deposit.

Mr. NELSON: With reference to Copp's anti-dip pipes, there may be some local influences at work to operate against the application of the dip-reliever; but since entering this hall, I have learned that a gentleman has used the apparatus for some months, and his increase of gas is 500 feet per ton of coal used. Under proper regulation, the deposit of carbon should be less with the anti-dip arrangement.

Mr. MITCHELL (Coatbridge): I can corroborate that statement, for I find only about one-third of the carbon I did before, proving that the dip was the cause of the extra deposit.

Mr. PEEBLES: If you open a gas-burner at the end of the pipe where the pulsations are going on, they will be visible, but I believe if a pipe is thoroughly stopped at the end, they will not go back.

Mr. YOUNG: The pulsations in this arrangement are transmitted against the current of gases, and I have no doubt that the pulsations are transmitted backwards against the current, as well as forward, just in the same way that sound travels against the wind. Of course, we all know that sound does not travel to such a distance against the wind as it does with it, because, as I have already explained, the pulsations which produce the sense of sound emanate, in all directions and die out to such an extent as to become inaudible; in fact, the wind travelling in the opposite direction to the pulsations of sound, so to speak, carries them backwards.

Mr. WHIMSTER: The dying away of the pulsations destroys the theory.

Mr. YOUNG: If the current had the effect of preventing the pulsations backwards, it would be impossible for me to produce pulsation in this arrangement by dipping this tube into the water, and allowing the gas from this Woulf's bottle to bubble through it; but you have had ample proof that such is the case.

Mr. PEEBLES: I beg to propose a most hearty vote of thanks to Mr. Young. I think we are all very much indebted to him for the way he picks up things lying before us all, and for the lesson he gives us in applying them. It is the quick ones among us that should give us these beautiful illustrations of the use of things lying as it were at our feet.

The PRESIDENT: The theory which Mr. Young has originated is a new and certainly a most interesting one, opening, as it does, a new field of thought and inquiry to all of us, of which we should be quite ready to take advantage, as, doubtless, most of us will, and I hope that before our next annual meeting the seeds sown to-day will have brought forth substantial practical results.

For want of time two papers, one by Mr. J. HALL, of St. Andrew's, and the other by Mr. S. DALZIEL, of Kilmarnock, were taken as read, and will be published in a subsequent number of the JOURNAL.

Dr. W. WALLACE, F.R.S.E., delivered a lecture on the "Bunsen Burner," a report of which will appear in the printed Transactions of the Association.

On the motion of Mr. G. R. HISLOP, a cordial vote of thanks was given to Mr. Macpherson for his conduct in the chair.

Later in the afternoon the members and their friends dined in the "Golden Lion" Hotel—Mr. Macpherson, President, in the chair; the Vice-Presidents acting as croupiers.

[We have received from Mr. Young, of Clippens, a number of corrections of our report of his remarks in the recent discussion on Mr. Mitchell's paper, inserted last week. These, as they stand, are too long for insertion as a letter, but the corrections will be made in the printed Transactions of the Association.—ED. J. G. L.]

PROPOSED PURCHASE OF THE LIVERPOOL GAS-WORKS.

At the Meeting of the Liverpool Town Council on Wednesday last—the MAYOR (Alderman Walker) presiding—the report of the Special Committee on the Supply of Gas, the consideration of which was postponed at the last monthly meeting, was resumed. The report recommended that the Finance and Estate Committee and the Special Committee should be empowered to negotiate with the gas company for the purchase of the gas-works, at a price to be agreed upon between the two committees and the gas company, subject to the approval of the council and the sanction of Parliament.

Dr. CROSS moved the adoption of the report. He said it would not be necessary for him to say more than a few words, because public opinion was almost unanimous in favour of the recommendation of the committee. He would only express a hope that the council would give permission to the committees mentioned to ask the gas company at what price they would sell their investment. He might, however, call attention to experiments which had recently been made with the electric light, and state that he had written for information respecting that mode of lighting, and had received a letter from Mr. Applegarth (on behalf of M. Jablochkoff), who, in his reply, said: "At the present moment it is impossible to state how far the electric light can be used for public lighting, but, as will be seen from the press, the Exeter Corporation have put an end to their negotiation with their gas company, which they intended to purchase. The recent experiments, and others which are being made almost daily, with electricity, will doubtless develop a state of things, twelve months hence, which will not only cause gas companies proposing to sell their property to moderate their pretensions, but altogether alter the value of gas shares. I shall be glad to receive from you communications from time to time, and will give you all the information I possibly can. Three months hence I hope to be able to tell you something definite." The Special Committee, in their report, made the following statement:—"The experience of other towns, and the information which has now been obtained, appear to the committee to lead to the conclusion that it is advisable, in the interests of the public, that the gas-works should be purchased by the corporation, if they can be acquired on fair terms. The company are, it is believed, not unwilling to sell to the corporation, but it may not be practicable to agree upon the price." He moved the approval of the report.

Mr. PEET seconded the motion.

Alderman LIVINGSTON said the adoption of the report committed the council to the purchase of the gas-works on certain terms, and he was one who would not consent to any such resolution, because he thought that it would be very undesirable to take such a leap in the dark. Until they had more information on the subject they certainly ought not to commit themselves to the purchase upon any indefinite terms, or in point of fact upon any terms. He moved as an amendment that the consideration of the subject should be deferred for twelve months.

Mr. PEARSON seconded the amendment.

Mr. LEWIS said he thought it was simply a waste of time to refer the matter to the committees, to ask the company upon what terms they would sell their undertaking. The cost would probably be something like a million sterling. In view of the great panic that had taken place in reference to gas in London, it would be unwise for the council to compromise themselves by entering into negotiations for the purchase of the gas-works. They knew very little at present; and he considered they ought to wait some further development of the new process, by which it could be utilized and applied, before they went any further. He opposed most decidedly the proposal of the committee.

Mr. WHITLEY hoped that the proposition of the chairman of the Gas Committee would be confirmed, for the reason that there could be no doubt that for a long time the consumers of gas had complained, rightly or wrongly, of the action of the gas company. There had, no doubt, been causes for complaint, and some of those causes he admitted had been mitigated and decreased; but he could not help thinking that the committee which had been sitting on this question had done a vast amount of good. If the Gas Committee were asking the council to affirm the principle upon which the gas-works were to be purchased, he could understand the objections which had been made to the present proposal; but that was not so—they only asked that they should ascertain the price upon which the gas company would sell. He thought it would be a great advantage if the gas-works were in the hands of the corporation. He was not one of those who believed in taking over business concerns under corporation management—he believed that generally they were not so economically managed by corporations as they would be by private individuals; but they had not to consider the question of economical management only—they had to consider the great complaints which had been made by the community whom they represented. He believed that gas and water, and all the essentials of civilized life, were better in the hands of a public body than in the hands of private individuals, who, of course, managed them for their own interest. He had gone carefully into the figures, with reference to the purchase of the gas-works, and he believed that they could be obtained at a price which would not cost the community a single shilling. He believed that by means of a reserve-fund and a sinking-fund they could acquire the gas-works without having any very great debt, and even that debt could be gradually diminished, so that eventually the gas-works would be very profitable to the town. In Manchester the gas-works had for many years been a great source of profit to the corporation, who had been enabled to reduce the rates in consequence. He, therefore, thought the council would not be carrying out the wishes of the burgesses, or acting in accordance with the interests of the town, if they declined the recommendation of the committee. The only difficulty that he saw in the

matter was the possibility of some other mode of illumination superseding gas, but anything of that kind he believed was very far off, and need not weigh much in the consideration of the council.

Alderman SAMUELSON said he believed that if the corporation were to purchase the gas-works, and undertake the management of them, they would soon come to a dead-lock, as they already had their hands full. He believed the conditions imposed upon the gas company were at present such that, if the corporation kept them up to the mark, gas might be supplied to the consumers upon very advantageous terms. Assuming that no new inventions came out, he thought it would be for the benefit of the community to allow things to go on as they were than for the corporation to trouble themselves with the purchase of the gas-works at any price.

Mr. FORWOOD said he thought it would have been better if Mr. Whitley or the chairman of the committee had given them a *primâ facie* statement of the figures and facts which in their mind had led them to think of the advisability of purchasing the gas company, for he was satisfied, upon consideration of the statement of the company and their position with regard to the town, that it would be a mistake to purchase them. In the event of buying up the concern, they would have to give the gas shareholders a sum of money that they could invest, and which would return to them the same amount of income they at present received out of the company. That sum would be on a 4 per cent. basis, and he did not suppose the corporation could borrow the money to buy the works on a better basis than 4 per cent., so that on that point they would not be any pecuniary gainers by the transaction. He did not think that management under the corporation would be any better than management under the directors of the company. The report of the committee contained the following paragraph:—

> In addition to the accountant's examination, the chairman has devoted considerable time and labour to a comparison of the transactions of the company with those of other gas companies with reference to the prices paid for coal and received for gas products, and to other questions which do not come within the province of the accountant. The result appears to show that both in buying coal and selling products the company have not acted so judiciously, or have not been so fortunate, as other gas companies; but it is impossible to say at present how far these matters may be satisfactorily explained, and the committee have thought it advisable to postpone taking any steps with respect to them until the council have had submitted to them the question of purchase.

He did not think that was a paragraph that should appear in the report, and if they were attacking the management of the company, it would be better that that attack should be made on the full responsibility of the committee, and not upon some general statement as to what the chairman had told the committee. It might be said that an advantage would be gained by the corporation in economizing the manufacture of gas and the extension of gas by the increase of the town. But if the company required to go for any further capital in order to extend their works for supplying the town or district, they would submit it to public competition, obtaining offers by auction. Therefore they would get the capital for the extension of the works just as cheap as the corporation. And as to the saving in manufacturing the gas, as he said before, he did not think the corporation would manage the concern any more economically than the company. Moreover, they would be taking upon themselves all the risk of new inventions, and they would not benefit by the purchase. He supported the amendment on these grounds.

Mr. M'DOUGALL reminded the mover and seconder of the amendment that the report of the Gas Committee was the result of three years deliberation, and it would scarcely be courteous to throw it right out of court without receiving it. With regard to the gas-works being a paying speculation, he thought that the profit might be extended. It was a fact, he believed, that quite one-half of the dwellings in Liverpool were not lighted with gas, and those houses were the very houses that ought to be supplied, and which the corporation should see were supplied—namely, the poorer houses. The gas company no doubt already supplied the consumers from whom the largest profit was made; but seeing that the shareholders of the gas company were allowed to receive 10 per cent., if the money to purchase the works could be obtained by the corporation at 4 per cent., there was a large margin in the difference for profit. He did not like the idea of two committees having to deal with the matter, which he thought might be left to the Finance Committee, who could call in the assistance of Dr. Cross, who had really been the Gas Committee. He thought that the report should be received, and that the question as to the purchase of the works should be referred to the Finance Committee.

Mr. PICTON said he thought, in justice to the committee, the council ought to receive the report. He was sure they all felt a considerable debt of gratitude was due to Dr. Cross for the great trouble and pains he had taken in the matter, and he was certain some good would result from his labours. But the proposal to purchase came before them at a very inopportune period. Experiments had been tried, not so much in England as in France, in which the utility of the electric light had been demonstrated in a very satisfactory manner; and he believed it was a fact that at present in the city of Paris a great many houses were lighted internally by means of the electric light. There was a great future before them as regarded the utility of electricity, both in reference to this and other departments of scientific application; and for them to enter into negotiations at the present juncture would be a very unfortunate thing. He for one was not prepared to vote for purchasing the gas-works, even if they were offered on reasonable terms, until they waited to see whether it was not likely, within some short period, that a better system could be adopted. He did not think they were now in a condition to entertain the idea of being prepared to purchase the undertaking on any terms, and it would be very foolish, as well as being scarcely respectful to the company, to ask them what they would take for the works unless the council really had made up their minds to purchase them. On that account it would be much better to receive the report and leave the other matter over for a time.

Mr. BOWER and Mr. CROSFIELD having spoken briefly in support of the motion,

Dr. CROSS replied, and said that the Gas Committee could have presented a fuller report, and were quite prepared to give every detail; but were they to do so they would certainly act against the interest of the ratepayers, and would inflict upon them the hardship of paying an additional £100,000 or £200,000. They, therefore, kept back the figures, although it rendered them liable to be suspected of having withheld information that they should have disclosed. He did not ask the council to confirm any negotiation, but simply to empower the committee to ask the company at what price they would sell. He had no doubt in his own mind of the great advantage of the corporation taking over the gas company; and if the question was put as to the management of the latter, there was matter in his private report that would really shock the morality of Liverpool.

The amendment was then put, and lost by 25 votes to 16.

Alderman WEIGHTMAN moved that the last paragraph of the report should be amended so as to read as follows:—"In order, therefore, that this question may be determined by the council, the committee beg to recommend that the Finance Committee should be empowered to confer with the gas company as to the possible purchase of the gas-works at a price satisfactory to the committee, and subject to the approval of the council and the sanction of Parliament." His only reason for throwing the Gas Committe over was that he objected to the combination of two committees, as they would be strong enough to override the council. He was, however, willing to leave it to the Gas Committee, and to strike out the Finance Committee.

Mr. YATES seconded the proposal.

Alderman BENNETT objected to the corporation possessing the gas-works at all, and nothing to his mind had been brought forward as to the necessity of making such a purchase. What had been said as to the purchase of coal, and other matters, by the gas company were all subject to arrangement, and could be controlled. To purchase the gas-works and establish them under the control of corporation officers would be one of the greatest mistakes that the council had ever made. The company were one of the oldest in the kingdom, and if the works came into the hands of the corporation no doubt that some energetic engineer or another would rise up and say that the first thing to be done was to put down new pipes, and patents would be taken out and all kinds of nostrums brought before the council, and they would bitterly regret, before one year was over, that they had made the purchase.

The amendment, on being put, was carried by 28 votes to 13.

Mr. BOWER then moved that the report of the Gas Committee, as amended, should be received, but, before taking any action upon it, that the committee be requested to continue their labours, and present a further report.

Mr. PEARSON seconded the amendment.

In the course of the conversation that followed,

Mr. FORWOOD called attention to the fact that at the meeting of the Gas Supply Committee on the 23rd of May, it had been resolved—"That Mr. Whitley be requested to ascertain if the gas company will give an assurance that in a purchase of the gas-works at an arbitration price the agreement shall contain a clause similar to paragraph 8 of the agreement between the Corporation and the Dock Board, contained in the Mersey Dock Act, 1875." The paragraph referred to is as follows:—"The sale and purchase here agreed on shall be deemed a voluntary act by the respective parties hereto, and shall not for any purposes whatever be regarded as a compulsory taking of the said hereditaments by the board." At the next meeting, however, Mr. Whitley reported that he had not been able to obtain any assurance that the gas company were willing to sell at an arbitration price. From these proceedings it was clear that there had been negotiations already.

It was objected by several members that from the memorandum just read it was clear that unauthorized negotiations had already been carried on.

Mr. WHITLEY, however, said it was only a private and confidential conversation between himself and another gentleman, which did not bind the Gas Committee or the Corporation in any way. There had been no negotiations in a business sense with the gas company, but simply a private conversation between two gentlemen.

The amended report was then put to the vote, and adopted by 25 votes to 17.

UTILIZATION OF SEWAGE.

On Friday, the 29th ult., Mr. ALFRED FRYER, Nottingham, addressed the Members of the Derby Town Council, acting as the Sanitary Authority, and gave "an account of certain processes for utilizing nightsoil and other town refuse, under which these accumulations are said to be practically reduced in bulk by burning, but the residuum is rendered most valuable as a manure." He commenced by remarking that he was not present to speak upon a vague scheme, but to explain a system of utilizing sewage which was matured and adopted to a large extent at Manchester and Birmingham, where apparatus at great cost was being erected, and he had that week signed a contract with the Corporation of Leeds. He referred to the importance of disposing of the refuse of towns in an economical manner, and at the same time without imperilling the health of the inhabitants or causing any infringement upon their sense of decency. It might be convenient, in considering the question so far as it affected most inland towns, to subdivide the refuse into three classes—refuse that could not be removed by water transit; refuse that must be removed by water transit; and refuse that may be removed by water transit. He proceeded by saying:—The groups of substances which cannot be removed by water are obviously solids, and these may be classed into mineral and vegetable matter. The former consists mainly of cinders and ashes from house fires, and, together with these, broken earthenware and glass, oyster shells, and some portion of metal. Where the old fashioned ashpits or middens exist, these substances are frequently soaked with water, and are offensive by the admixture of fœcal matter. Though these substances contain a portion of combustible matter, they are blended with so much incombustible material, they are so choked with dust, and saturated with water, that instead of being capable of ready ignition they would quench any ordinary fire upon which they might be placed. This material is very difficult of disposal. It possesses no value as manure, when piled in heaps it often becomes offensive, and as the dust-bin is usually the receptacle of solid refuse, it contains the dust and rubbish swept from the rooms of small-pox and scarlet fever patients, and not unfrequently portions of clothing which spread the germs of disease in the air, and serve to convey it still more certainly to the homes of poor creatures, who often search the refuse to glean such perilous treasures. No wonder that zymotic disease starts out without apparent cause in the lower parts of the towns, where it can be conveyed to them as effectually as the plague was carried from London in some woollen clothing to your own mountain Derbyshire martyr village of Eyam, 211 years ago. The Health Committee of Manchester have for some time demonstrated that ashes and clinkers when ground with hydrate of lime make a most excellent and tenacious mortar. They were, however, unable to deal with the refuse I have adverted to. They could not burn it *en masse*, and if any of the material tainted with fœcal matter were used, the mortar became offensive.

To deal with this difficulty the patent destructor was devised. The object aimed at was a furnace so arranged that when once ignited, the radiant heat generated should not be permitted to escape, but should be reflected upon the material so as to intensify the combustion and raise the temperature as much as possible. This having been effected, the heated products of combustion should be passed over a further supply of material, which could thus be deprived of its water, and raised in temperature ready for active combustion when its turn came to reach the furnace proper. Such, then, is the destructor. The material treated is frequently undistinguishable from wet mud. Cartloads of bricks saturated with water or urine, bottles, glass, &c., are shot into these furnaces, and they are made red hot. All water is evaporated, all organic matter is decomposed, all combustible matter is consumed, and the mineral matter alone is left "purified as by fire." No smell is produced by the burning. Two-thirds of the mass disappear, and the residue of ash and clinker, fused glass and earthenware offering sharp angular fractures, furnishes, when ground with lime, a mortar for which there is abundant demand. There is no fear of being undersold, for as one of the raw materials is worth less than nothing, other makers not possessing similar advantages may be working to a loss, while the makers of vitrified mortar will be reaping a profit.

The destructor requires but little attention. It is almost self-feeding; the material slips down the sloping bottom of the furnace, and the clinkers are easily withdrawn at the furnace mouths. The destructor furnaces are a series of cells. The cost of each cell for ironwork is about £80, to which the cost of brickwork needs to be added. The royalty is less than the cost of placing the refuse in a cart, or wheeling it across a road. The heat generated by the destructor furnishes power for grinding the mortar and for other purposes to be described later. Each cell deals with 140 cwts. per day. By this mode of treatment the solid mineral refuse is absolutely got rid of, without injury to contemporaries or to posterity. No danger is to be apprehended from the spread of diseases, no accumulations remain, and that which was an incumbrance becomes a marketable commodity. It remains to be added that at Manchester the difference between cost and sale price leaves the corporation a profit on the trade of mortar making.

Having disposed of the mineral solid refuse, let me invite your attention to the vegetable solid refuse. This consists of garbage, part of which is brought with the ashes and part is found in the pails. It includes the sweeping of the markets, also straw, shavings, rags, sacks, and an endless assortment of minor articles. To destroy absolutely these things would be wasteful, as they constitute the raw material out of which is made one of the most valuable substances for a Sanitary Committee. I allude to charcoal. A portion of the cinders before referred to, as food for the destructor, presents the needful fuel; and all that is required is a form of apparatus that shall, without much labour, and without producing any offensive odour, convert the garbage into charcoal. Condemned food, stale fruit and vegetables, are readily disposed of by the carbonizer. Sweepings of paved streets contain much vegetable matter, portions of hay and straw, horse-droppings, &c. These are readily carbonized, and the charcoal thus produced, as well as that from the more exclusively vegetable matter before adverted to, is most valuable as a deodorant.

Having alluded to the great value of the charcoal thus produced, as a deodorizer, he said: When street-sweepings are ground up with a certain portion of clay, and carbonized, they produce a charcoal of active power, and so little friable in its nature as to make an excellent filter-bed. This form of filter is used by various dyers at the present time, and the process also. The carbonization of street-sweepings is the subject of patents held by the Universal Sewage Company.

The carbonizer, like the destructor, is composed of a series of cells, each of which deals with 50 cwts. of garbage per day. You have now been so good as to traverse with me the first of our three divisions—viz., the treatment of dry refuse, and we have converted it into mortar and charcoal. We will now briefly consider the substances that must be removed by water transport:—

a. They consist of the involuntary supply.
b. Of the voluntary supply from dwelling-houses.
c. Of the voluntary supply from other places.

The involuntary supply consists of the rain water that finds its way into the rivers, of natural springs, of leakage from the water supply.

These are all natural feeders of rivers; the former two would exist if the town were absent, and the latter is no source of contamination. So far, then, as these are concerned, there is little that even the fastidious may complain of.

The voluntary supply from domestic sources consists of water used for washing and culinary purposes. As the impurity from these sources consists mainly of soap and fat, and very little of nitrogenous matters, it is evident that, were the contents of sewers confined to these substances, a very moderate treatment, either by precipitation or filtration, would suffice to render the water fitted to enter streams.

That which enters the rivers from manufactories consists largely of dye-stained water, from which, as we have seen, the colour may easily be discharged. From many works the water from the condensers of steam-engines is simply raised in temperature.

Besides these there are some fluids which, when untreated, are unfit for discharge into streams. Thus it appears that the liquids that must of necessity find their way into rivers do little to pollute them, and may be rendered pure by a moderate treatment.

We have only now to consider the third class of this refuse—viz., the substances that may be water-borne, but which also may be excluded from sewers.

These are manifestly the contents of water-closets and the drainings of public urinals, cesspools, and stables. These substances are all highly offensive. They are the vehicles for the spread of cholera and enteric or typhoid fever. They are the substances which generate poisonous river gases. They are those which pollute streams, and until the organic matter be decomposed they are dangerous to health. Even when the decomposition has been effected, and the nitrogen has associated itself with oxygen, so that it is found in the form of nitrates and nitrites, the mind still revolts at the introduction of human refuse, even so decomposed, into potable water.

Whilst sewers charged with these offensive and dangerous matters are unfitted to be discharged into rivers, they are at least as objectional to the inhabitants of the town.

Sewers so charged are contrivances for the elimination of sewer gases, and these readily find their way into dwelling-houses through improperly trapped drains. This, however, is not the whole source of mischief; the poison will find its way into dwellings through porous soils.

The death of Prince Albert at Windsor, and the alarming attack of enteric fever which the Prince of Wales contracted at Scarborough, show that those in the most exalted stations are not safe from the danger of sewer gases.

The modern system of dealing with sewers would be amusing, were it not so serious a subject. In order to conceal the sewage and escape the offensive effluvia, we convey it away in costly underground closed sewers, and as by these means we have not hindered the production of sewer gases, which will force their way into dwellings if not suffered to escape elsewhere, ventilators are attached here and there to ensure the discharge of the poison into the open air.

Let it be noted that when soluble organic matter is once mingled with much water it cannot be extracted by any method of precipitation, and even when applied on irrigation farms only a portion remains. Nor should it be forgotten that the substances which are innocent in sewers are valueless out of them, whereas the very substances which are so objectionable in sewers and rivers possess a considerable value when isolated and concentrated.

Unless, then, there should seem to be some great difficulty, practical or financial, it would seem to be a self-evident proposition that "the best or simplest method to make sewers innocuous is to keep them innocuous." This leads us to the pail system. Even where this method is adopted without the improvements which experience has suggested, it presents a natural, sensible, simple, and effective mode of removing the offensive material. The improvements referred to are—1. That the pails should be thoroughly cleansed and purified before being replaced. 2. That each closet shall be supplied with a little charcoal. 3. That the pails should be changed frequently. 4. That the pails shall be carried away in a closed van of wrought iron that should be absolutely steam-tight, or rather odour-tight. The importance of this will be appreciated by those who have stood in the wake of one of the ordinary vans. The pails may be closed with rubber-packed lids, which are supposed to be tight; but so long as here and there a pail leaks there is a trickling of offensive matter along the street, and a waft of sickening odour that marks the track of the van. Yet it is as easy, with proper appliances, to restrain the odour within the van as the scent within a vinaigrette, or the ammonia in a bottle of smelling salts. Such a van, possessing also minor advantages, which I will not trouble you with, we have devised.

We see, then, how the closets can be preserved sweet, and how the material can be transported to the depôt without a trace of nuisance. Let me here introduce a paradox. The dirtier the process, the greater the cleanliness needed. Not only should vans and harness be kept clean, but the men employed should be clean in their persons and dress also. Each man might wear a glazed hat, and have daily supplied to him a clean canvas jacket, and a dark, but clean apron to protect his trousers. Having taken the fœcal matter to the depôt, the mode of disposal of it must now be considered. Human urine is well known to be the most valuable manure existing, but this valuable material is diluted with 30 times its weight of water. The removal of this water is the object sought, and the difficulties are so great as to have been considered by Mr. Bawlinson and others insuperable.

The odour from highly-heated urine is most offensive. Heat decomposes urea and drives off ammonia, and this valuable alkali is volatile at very low temperatures.

Yet the problem has been solved. No offensive odour whatever, and not even the faintest odour of fœcal matter or urine escape during the operation. Not a particle of ammonia is lost. The apparatus is not an untried one, but has been largely used during the last ten years in the concentration of cane juice. The process requires no chemicals and no skilled attendance. The concentration is effected in the concretor.

By this means nearly all the water is removed, and the already existing ammonia is fixed by the sulphurous acid in the gases from the destructors. As the process is simple, and the heat is furnished, as it were, gratis, it is not wonderful that the concentration is effected economically. This concentrated matter is named water charcoal, and forms a really valuable manure.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

The action of the Scotch pig iron producers in blowing out a large number of furnaces, in order to reduce the output, and the determination of the Cleveland ironmasters to adhere to their resolution to make cash terms signify cash against delivery, have had the effect of rendering pig iron prices slightly harder here and in the Leeds district. Concurrently with these causes, there is a report in circulation that some of the local smelters are also on the point of putting several furnaces out of blast, in order that their stocks—some of which are of considerable proportions—may be reduced prior to the possible revival of trade in the autumn. At present, pig iron prices—which are just now of rather more interest than ordinary—range about as follows:—"Aireside," Leeds, No. 1, 53s.; No. 2, 49s.; No. 3, 47s.; No. 4, 46s.; Forge, 46s.; M, 45s.; W, 44s.: "Acklam, Yorkshire," No. 1, 46s.; No. 2, 44s.; No. 3, 42s.; No. 4, 41s.; Forge, 40s.; M and white, nominal: North Yorkshire, G. M. B., No. 1 foundry, 44s.; No. 2 foundry, 42s. 6d.; No. 3 foundry, 40s.; No. 4 foundry, 39s. 6d.; No. 4 forge, grey, 39s.; No. 5 forge, mottled, 39s.; No. 6 forge, white, 38s. 6d.; Refined metal, 55s. 6d.; Kentledge, 43s.; Cinder, 37s.; Lincolnshire foundry, 57s. 6d. to 47s. 6d.; and forge, 49s. to 42s. 6d., according to brand; Derbyshire, 60s. to 47s. 6d. for foundry, and forge, 40s. to 50s. per ton.

Merchant iron of all descriptions is quiet at the recently quoted low and almost profitless rates. The coal trade is only very indifferently engaged on the whole, the house coal branches being particularly depressed. This being the best part of the season for the steam coal business, it is not surprising to observe that those collieries are fairly well engaged on export account, the bulk of the shipments of 22,000 to 26,000 tons a week being sent from Hull and Grimsby. The steam coalowners met at Barnsley last week, and decided, after some discussion, to allow prices to remain as before—9s. per ton for that class of fuel; at the same time it is well known that at least one large railway company are obtaining loco' coal in their own waggons at 7s., or thereabouts, per ton. Gas coal is steady, and not largely sold in the open market, at 7s. to 8s. 6d. per ton.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The Lancashire coal trade continues in a very depressed condition, and in some classes of fuel sellers have had to give way in their prices. In the Manchester market there has been a general downward movement in best coal and burgy, which have been reduced 10d. and 5d. per ton respectively, but common coal and slack generally are without change. In one or two other districts there have also been some slight alterations in the list rates, and generally prices are weaker. For round classes of coal there is very little demand. The house fire trade is extremely quiet, and considerable stocks are accumulating, both in the yards and on the pit banks. Common coal does not move off very freely, and lower prices are being taken in some quarters. Good Arley coal at the pit mouth can be got for 10s. per ton; Pemberton four-feet, 8s.; and common coal at from 6s. to 7s. per ton. There is no very material change in the gas coal trade, and sellers still find it difficult to secure contracts except at very low prices, large orders for good screened Arley being taken at 8s. 6d., and for ordinary screened gas coal at 7s. 6d. to 7s. 9d. per ton. Engine classes of fuel, although the better sorts still meet with a tolerably good demand, are not quite so stiff as they were, and colliery proprietors are finding it difficult to maintain the slight advance which was made during the strike. Good burgy can now be got for from 5s. to 5s. 6d. per ton at the pit, and slack at from 3s. 6d. to 4s. 6d. per ton.

Although, practically, the strike in the Wigan district is now over, very few of the pits have, as yet, got fully to work. This reduction in wages is now being followed in other districts. The men employed by the Clifton and Kersley Coal Company have received notice of a reduction of 2s. per week, and this will affect over 2000 hands. A large number of the men in the employ of Messrs. A. Knowles and Sons have also received notice of reductions ranging from 2s. to 2s. 6d. per week, and in the Ashton district a reduction of 2d. in the shilling is being made in colliers wages. It is stated that notices are also to be served upon the men employed at the collieries in the Bolton, Clifton, Pendlebury, and Pendleton districts.

In the iron trade there is no improvement, and no prospect of improvement. The local makers who are being undersold in this district by north country firms are selling very little, and it is probable that the production of common iron will be still further reduced. For delivery into the Manchester district, 54s. to 55s. per ton for No. 3 foundry, and 53s. for No. 4 forge are still being asked; but if orders were to be secured, a trifle less than this would, in all probability, be taken. Finished iron is without change, as sellers, finding it impossible to meet the requirements of consumers with regard to prices, are, as a rule, adhering to late rates.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The trade of the North of England shows heavy shipments of all classes of coals, notwithstanding the dull times. Last week above 90,000 tons of all sorts were exported from the Tyne Dock alone. A considerable amount of coal was likewise loaded on board vessels from the staiths on the Tyne and Wear, and likewise from the Northumberland Dock. There is no pressing demand for gas coals of any kind in the open market. Gas companies who entered into contracts for coals, to be delivered over the course of the year, if they fix their own ships, will find that they have saved at least 6d. per ton upon freight to what they had to pay in the early part of the season. The low freights to the Baltic, Mediterranean, and Holland favour the shipment of seaborne coal. There is no doubt, under present circumstances, British coals can work the continental out of most of the markets where there is any competition. Most of the continental pits have a considerable railway haulage before the coals reach the seaboard, whereas ours are carried by sea, and at present most of the freights to the Baltic are from £3 to £3 10s. per keel less than in ordinary seasons.

It is quite evident that a good deal of Durham coal is sent to the Continent upon consignment. It could not be otherwise upon the face of it; for though English merchants complain in all directions that there are no continental orders in the market, the shipments thence are equal to the most prosperous periods of the coal trade. The fact is there is little local demand; at the same time if a slight margin of profit can be established, as the ordinary expenses of a colliery are running whether it yields a large or small quantity of coals, the coalowners try to get as large a production from their pits as they can, and take the risk of the prices current upon the continental exchanges. The price of gas coals on Newcastle Quay is unchanged. There is a good demand for the best sorts of steam coals for Russia. The inquiry is pretty good also for second-class sorts.

There was a large supply of every variety of tonnage in the coal ports last week. Coasting rates alter very little, and some idea may be formed of the probable trade to London for the remainder of the year when it is reported that a steamer was fixed last week, for six months definite, at 4s. 6d. per ton.

There is no alteration at all in the general character of manufacturing business. More iron is being shipped to the Continent, and there appear to be better exports of chemicals and fire-clay goods. That may be expected as the autumn begins to approach, for merchants will naturally have to keep up some sort of stock in the winter, especially in the Baltic. The Cleveland iron trade is without any change. Iron is manufactured in about average quantities. A market is found for it somehow, but there is a general complaint that it is a profitless sort of business. There was rather more inquiry for some sorts of chemicals last week, but the advance of prices was not very material.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The price of gas in Dingwall has been reduced 2s. per 1000 cubic feet, and the rate is now 10s.

On Thursday last the annual meeting of the Carluke Gaslight Company was held—Mr. A. C. Selkirk in the chair. The balance-sheet and directors report were submitted and approved of. They showed the affairs of the company to be in a favourable condition. A dividend of 6s. per share was declared, payable immediately, and six directors were re-elected for the current year. A meeting of directors was subsequently held, when it was agreed to reduce the price of gas forthwith from 5s. 10d. to 5s. 5d. per 1000 cubic feet.

On Friday week the annual meeting of the shareholders of the Cullen Gaslight Company was held—Mr. William Duffus presiding. An account of the company's transactions for the year ending July 1, 1877, was submitted and approved of, and a dividend of 5 per cent. on the stock of the company was declared. The meeting resolved to give effect to the recommendation of the directors, by reducing the price of gas from and after the 22nd of May last to 8s. 9d. per 1000 cubic feet.

The annual meeting of the Vale of Leven Gaslight Company was also held on the same day—Mr. N. Nicholson, chairman, presiding. A dividend of 10 per cent. was declared, and it was resolved to reduce the price of gas 5d. per 1000 cubic feet, thus making the ordinary price 5s. 5d., and the price to large consumers 4s. 4d., the reduction to take effect from the 1st of May last. In consequence of the costly extensions—including new tank, gasholder, &c.—not being completed, it was considered desirable to re-elect all the retiring directors, which was accordingly done.

The Town Council of Arbroath met as the Gas Corporation on Monday, the 30th ult., for the consideration of the annual accounts, a brief notice of which was given in last week's "Trade Notes." A very comprehensive report was submitted by the manager, Mr. David Terrace. It dealt with the coals used and in stock, the gas sold per ton of coal carbonized, the leakage or unaccounted-for gas, a comparison of the last two years make of gas, the retort-benches, purifiers, 18-inch governor, meter and distributing plant, &c. In the years 1870 to 1875 the production of gas from each ton of coal carbonized was on an average 10,125 cubic feet, and the quantity sold per ton was 8364 cubic feet, whereas in the past year the make was on the average 10,521 cubic feet per ton, and the gas sold 9259 cubic feet, being an increase of 895 feet sold per ton, or equal to 10·7 per cent. The average leakage or unaccounted-for gas during the first five years of the corporation's occupancy of the works was 17·5 per cent. It is satisfactory to know that the leakage has now been reduced to 12 per cent. of the quantity registered by the station-meter. In opening the discussion upon the annual accounts and the manager's report, Provost Shield remarked that the report spoke volumes for the management of the gas-works during the last twelve months. He then went over the principal items in the balance-sheet, and said that for the satisfactory results brought out the corporation were, in a great measure, indebted to the excellent management of Mr. Terrace, who possessed a thorough knowledge of his business in all its parts, and was very attentive. Eventually, it was declared, in accordance with the Act, that half of the profits be handed over to the magistrates and town council. The balance would allow a rebate of 2½d. per 1000 feet to the consumers; but as there would be a deal of extra labour in making the calculations for the halfpenny, it was agreed that the rebate should be 2d., the same as last year, the balance being carried to the credit of the consumers.

A meeting of the Town Council of Hamilton was held last Thursday evening, for the purpose of making appointments in accordance with a resolution come to some time ago to cause a re-arrangement with regard to the managership of the works and the collectorship of the accounts, both of which have hitherto been combined in the same person. Mr. John Johnstone, Hamilton, was elected to the first-named post, and Mr. James Mackie, jun., also of Hamilton, was appointed collector.

The usual monthly meeting of the Dundee Gas Commission was held on Monday, the 30th of July. It was reported that the coal in stock on the 30th of June amounted to 3802 tons, that 8,151,100 cubic feet of gas had been manufactured during the month of June, and that the average illuminating power of the gas was equal to 26·63 standard candles.

A meeting of the Works Committee was held at Lochee on Thursday, in connexion with the extensions now in progress for the gas supply of that part of the town of Dundee. They found that a new gasholder-tank, 101 feet 6 inches in diameter and 20 feet deep, had been completed, and that workmen were engaged in constructing the gasholder for it, which will be capable of containing 140,000 cubic feet of gas. It is to be filled from the works at Dundee, and the main for that purpose has now been laid. There is every probability that the gasholder will be ready for the supply of gas to Lochee by the beginning of October—the time specified in the contract. It will be large enough to supply gas to the whole of Lochee, and the total cost, including price of ground, tank, and holder, is estimated at a little over £5000.

The shareholders of the Lanark Gas Consumers Company, Limited, held their annual meeting last Friday evening, when the annual balance-sheet and report were presented for consideration. It was shown by the balance-sheet that there were profits available for a dividend of 15 per cent., when, taking into consideration the interest paid on debentures, which is all dead stock, the capital being in excess of the requirements as compared with the income, the meeting agreed to declare a dividend of only 5 per cent., as usual, the balance being carried forward to the reserve-fund, for the improvement of the works, as, according to the manager's report, a large sum was required to put them in efficient order for manufacturing and distributing gas with economy. He estimated that as much as £300 would be required for the re-arrangement and extension of the purifying apparatus alone, which the directors recommended should now be done. The price of gas was fixed to remain at 5s. per 1000 cubic feet. The affairs of this company deserve more than a passing notice, in consequence of the example afforded of the injurious results which may happen through competition between two companies in a small town. After ten years competition with the old company, and the ultimate purchase of their plant, the new company found that when the amalgamation was effected they had some £2500 of stock not returning any profit. The item of unaccounted-for gas stood at from 30 to 40 per cent.; very soon there was an overdrawn account at the bank of £1000; there was no reserve-fund; the works generally were in a bad condition for working with economy; the price of gas was at 8s. 4d. per 1000 cubic feet; for some years previous to the amalgamation there was very little, and sometimes, indeed, no dividend; and the old company's finances were even in a worse state. Since the year 1873, the price of gas has been reduced from 8s. 4d. to 5s. per 1000 feet, at which it has now stood for nine months. The annual profits have exceeded 25 per cent., and have been applied to the payment of the overdrawn account and £400 of bonds, and in placing a credit of £575 at the bank, the shareholders only receiving 5 per cent. annually. This favourable state of affairs is, no doubt, due, in great part, to the reduction in the price of coal; but the following circumstances also deserve consideration—namely, reduction of unaccounted-for gas to 10 per cent., better management, reduction of debt, no opposition to contend with, and an increased consumption amounting to 30 per cent. One part of the manager's report explained that an expenditure of £985 was absolutely necessary for manufacturing and distributing gas with economy, and that without it they were only dabbling in gas-works management. In conclusion, it may be mentioned that while the shares of the company were sold three years ago at 10s. each, several hundreds of them have changed hands lately at from 20s. to 21s. each.

The Glasgow Corporation Water Committee have resolved upon laying about 4¾ miles of 36-inch cast-iron pipes, which are required for completing the middle section of the high district main and the west district main between the Mugdock Reservoir and the city.

At one time it was feared that there might be a scarcity of water at Wishaw during the present autumn, but owing to the very frequent occurrence of rain during the past few weeks there is now no danger of such an untoward result. The new works are making good progress.

The fortnightly report just issued by the Edinburgh and District Water Trust shows that at present all the reservoirs are full, the total quantity in gallons amounting to 679,657,152, or an increase of 12,887,621 gallons. The delivery in Edinburgh has been 5694·22 gallons per minute, equal to 28·59 gallons per head per day, to a population of 286,800.

In the month of May, 265,000 gallons of water went over the bye-wash at Clatto reservoir every 24 hours, and which is alleged to represent wasted water, or water which might have been used profitably in the town of Cupar. In June the wasted water amounted to 679,000 gallons per diem, and similar waste is said to be still going on. The amount sent into Cupar on the 3rd of July was 94,241 gallons, being at the rate of 15½ gallons for each unit of the population, and which some members of the community think is too little.

A requisition from a number of the inhabitants of Jamestown, Dunbartonshire, is about to be presented to the local authority of the parish of Bonhill, for the purpose of forming that village into a water supply district.

The Glasgow pig iron market was very firm in the early part of last week, but towards the close it became languid. Warrants were up at 55s. 5d. on Tuesday, but as low as 55s. 1d. cash was taken on Friday. The closing prices on Friday afternoon were 55s. 2d. cash, and 55s. 3d. one month, the final transactions being 1d. per ton over the closing price of the previous Friday.

There is no appearance of any change for the better in the coal trade. Prices seem to be rather easier.

MALVERN LINK GAS COMPANY.—The thirty-first half-yearly meeting of this company was held on Thursday, the 2nd inst., when a dividend of 7 per cent. was declared.

NEWCASTLE (STAFFS) GAS COMPANY.—At the annual meeting, on the 28th ult., the usual dividend of 10 per cent. on the old shares, and 7½ per cent. on the new ones, was declared.

SALE OF PROVINCIAL GAS SHARES.—On the 28th ult., there were sold by auction nine shares in the Frome Gas Company. Six £25 shares, fully paid up, averaged £51 9s. 2d. each, and three with £15 paid up averaged £21 14s. 2d. each.

REDUCTION IN THE PRICE OF GAS AT STOCKTON.—At the quarterly meeting of the Stockton Town Council, held last Friday, the Gas-Works Committee recommended that the discount on the price of gas be increased from 10 to 20 per cent. to all consumers, making it 2s. 8d. instead of 3s. per 1000 feet as at present. The minutes were confirmed.

QUALITY OF THE BIRMINGHAM GAS.—From the report of Mr. T. Jackson, the corporation gas examiner, it appears that during the month of July, at the four gas-making stations, 16 examinations were made of the illuminating power of the gas supplied to the borough. The maximum light in sperm candles was 18·22; minimum, 16·69; average, 17·22. The parliamentary standard is 15 candles, with Sugg's No. 1 "London" burner.

THE TRANSFER OF THE STOCKTON AND MIDDLESBROUGH WATER-WORKS TO THE CORPORATIONS.—The arbitration which is to determine the amount of compensation to be paid to the Stockton and Middlesbrough Water Company under the Act of 1876, for the compulsory transfer of their undertaking, is fixed to take place in London during the month of October. The arbitrator for the company is Mr. Thomas Hawksley, C.E., and for

the corporations, Mr. Venables, Q.C. The umpire will be Mr. Napier Higgins, Q.C.

QUALITY OF THE NEWCASTLE-ON-TYNE GAS.—Mr. John Pattinson reports as the results of his examinations, for the month of July, of the quality of the gas supplied to the borough by the Newcastle-upon-Tyne and Gateshead Gas Company:—

Date.	Illuminating Power in Sperm Candles.	Grains of Sulphur in 100 Cubic Feet of Gas.	Sulphuretted Hydrogen.
July 3	15·4	9·52	Nil.
„ 6	15·7	10·02	„
„ 10	14·5	10·34	„
„ 13	15·0	9·62	„
„ 17	16·0	7·79	„
„ 20	14·6	7·88	„
„ 24	15·5	9·32	„
„ 27	15·0	9·48	„
„ 31	14·5	8·13	„

A Sugg-Letheby standard Argand burner is used in testing. According to Act of Parliament, the gas should not be of less than 14 standard candles illuminating power, nor contain more than 17 grains of sulphur per 100 cubic feet of gas.

Register of New Patents.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

448.—WIGHTMAN, G., Elkaley, Nottingham, and ALLEY, S., Glasgow, "Improvements in water-meters." Feb. 2, 1877.

523.—THOMAS, J., Aberdare, Glamorgan, "Improvements in direct-acting steam-pumps." Feb. 7, 1877.

552.—BENNET, H., and BOSTOCK, I., Rugeley, Staffs, "Improvements in pumps." Feb. 9, 1877.

1001.—CRICKMER, R. J., Homerton, London, "Improvements in steam and other cocks or taps." March 13, 1877.

1427.—CHEESBROUGH, F. J., Liverpool, "Improvements in and appertaining to apparatus for lighting gas-lamps, cigars, and for other like purposes." A communication. April 12, 1877.

PATENT WHICH HAS BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

2024.—BENTLEY, W. S., and ISHAM, W., "Improvements in apparatus for economizing and purifying gas." July 18, 1870.

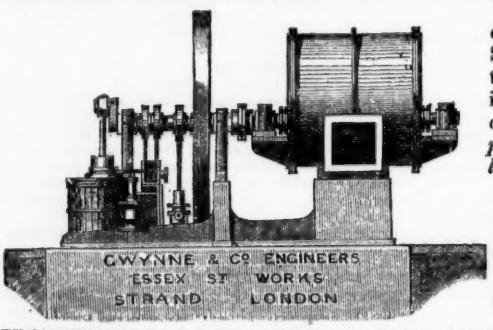
Share List of Metropolitan Gas and Water Companies.

(Corrected by Mr. F. N. GOLDING, Sun Court, Cornhill, from the latest Stock Exchange Quotations.)

Number of Shares issued.	Amount per Share.	Name.	Amount paid up per Share.	Last Divd. p.Cent. p. Ann.	Latest Quotations.
	£	GAS COMPANIES.	£ s. d	£ s. d	£
10000	20	Angio-Romano . .	20 0 0	9 0 0	20—22
5000	20	Bahia (Limited). .	20 0 0	2 0 0	11—13
1000	20	Do., do., redeem.	20 0 0	2 0 0	25—27
1500	20	Do., 2nd pref. . .	20 0 0	7 10 0	21—22
40000	5	Bombay (Limited).	5 0 0	7 10 0	6¾—7¼
10000	5	Do., fourth issue.	4 0 0	7 0 0	5—5½
10000	20	British (Limited) .	20 0 0	10 0 0	41—43
7500	20	Cagliari (Limited).	20 0 0	5 0 0	118—119
5500001.	Stk.	*Commercial*	100 0 0	10 0 0	204—208
70000	100	Do., 7 per cent. .	..	..	146—150
20000	20	Continental Union.	20 0 0	6 0 0	19½—20½
10000	20	Do., new	12 10 0	6 0 0	⅜ds–½pm
10000	20	Do., preference .	20 0 0	7 0 0	25–27 xd
75000	Stk.	*Crystal Palace District*	100 0 0	10 0 0	205—210
125000	Stk.	Do., 7 per cent. .	100 0 0	7 0 0	145—150
50000	Stk.	Do., preference .	100 0 0	6 0 0	134—138
23406	10	European(Limited)	10 0 0	10 0 0	18–19 xd
12000	10	Do., new shares.	7 10 0	10 0 0	6—7 xd
35406	10	Do., new shares .	5 0 0	10 0 0	4–5 pxd.
37977701	Stk.	*Gaslight & Coke* A.	100 0 0	10 0 0	202—207
1000001.	Stk.	Do. B.	100 0 0	4 0 0	85 - 90
50000	10	Do. 5 per ct. pref. conv., 4th issue.	8 0 0	5 0 0	7—8 pm.
50000	10	Do. do., 5th do. .	2 0 0	5 0 0	6¼–7¼pm
2000001.	Stk.	Do. C 10 p.c. pref.	100 0 0	10 0 0	222 – 230
3000001.	„	Do. D do. do. .	100 0 0	10 0 0	220— 230
1650001.	„	Do. E do. do. .	100 0 0	10 0 0	220—230
300001.	„	Do. F 5 do. do. .	100 0 0	5 0 0	114—116
600001.	„	Do. G 7½ do. do. .	100 0 0	7 10 0	150—160
13000001	„	Do. H	100 0 0	7 0 0	148—151
6200	5	Georgetown, Guiana	5 0 0	5 0 0	..
5800	10	Hong Kong (Lim.)	10 0 0	10 0 0	18–20
50000	50	*Imprl. Continental Gas Association*	45 15 0	9 10 0	88—91
2500001.	Stk.	*London*	100 0 0	10 0 0	200—210
1500001.	Stk.	Do., 1st pref. . .	100 0 0	6 0 0	138—143
14450	Stk.	Do., 2nd pref. . .	100 0 0	6 0 0	115—120
4350	Stk.	Do., 3rd pref. . .	100 0 0	6 0 0	115—120
7622	25	Do., A shares . .	12 10 0	6 0 0	34—36
268051.	All	Do., Debent. stk.	100 0 0	5l. & 6l.	..
15000	5	Malta and Mediterranean (Limited).	5 0 0	2 0 0	2—3
6000	5	Do., preference .	5 0 0	7 10 0	5—5½
23000	5	Mauritius (Limited)	2 0 0	..	¼—1
25000	20	Monte Video (Lim.)	20 0 0	8 0 0	18½—19½
8000	10	Nictheroy, Brazil (Limited)	10 0 0	3 0 0	..
30000	5	Oriental (Calcutta).	5 0 0	9 10 0	7-7¼ xd.
30000	5	Do., new shares .	3 0 0	9 10 0	1⅞–2⅛pm
10000	5	Ottoman (Limited).	5 0 0	3 0 0	2—3
17500	10	Pará (Limited) . .	10 0 0	7 0 0	5—6
27000	20	*Phœnix*	20 0 0	10 0 0	40—42
3600001.	100	Do., new	60 0 0	7 10 0	100—105
1444001.	Stk.	Do., capitalized .	100 0 0	5 0 0	100—105
		Do., new, 1876. .	..	..	17–18pm
36000	20	Rio de Janeiro (L.)	20 0 0	10 0 0	31—33
7359	5	Singapore(Limited	5 0 0	7 10 0	5¼—5⅞
2000	5	Do., preference .	5 0 0	7 10 0	5¾—6¼
1500	32½	Shanghai	32 10 0	12 0 0	30—32
4000	50	*South Metropolitan*	50 0 0	10 0 0	100—105
4000	12½	Do.	12 10 0	10 0 0	25—27
20000	12½	Do., new shares .	10 10 0	10 0 0	12½—13 pm.
		Surrey Consumers.	10 0 0	10 0 0	19½—20½
10000	10	Do., new	8 0 0	10 0 0	7½–8½pm
9000	4	United General . .	4 0 0	2 10 0	3 - 3½
1500	10	*Wandsw. & Putney*	10 0 0	10 0 0	19–20
2957	10	Do.	10 0 0	7 10 0	11–12
993	10	Do.	10 0 0	7 0 0	..
26000	5	*West Ham*	5 0 0	10 0 0	7½—8½
		WATER COMPANIES.			
12000	100	Chelsea	100 0 0	6 0 0	144–7 xd
1800000	100	East London . . .	100 0 0	6 0 0	153–6 xd
5840	25	Do., ¼ shares . .	25 0 0	5 0 0	35½—36½
2160	25	Do., new ditto; max. div., 7½ p.c.	25 0 0	5 0 0	31—33
547960	100	Kent	100 0 0	8 0 0	197—200
970	100	Lambeth	100 0 0	6 5 0	144—147
1161	100	Do., max., 7½ p.c.	100 0 0	6 5 0	142—145
442	100	New River	100 0 0	7 0 0	320—350
4475	100	Do.	70 0 0	7 0 0	270—300
400000	100	Do., deb. sk., 4 p.c.	100 0 0	4 0 0	103—105
3036	100	Southwrk. & Vauxh.	100 0 0	4 0 0	106—109
1296	100	Do., pref. stock .	100 0 0	5 0 0	113—116
..	100	Do., D shares . .	100 0 0	4 0 0	105—108
..	..	Do., 4½ preference	100 0 0	4 10 0	106—108
..	100	Do., new ordinary	..	4 10 0	..
1600	100	Do., new ord. No. 1	40 0 0	4 10 0	106—108
12172	61	West Middlesex . .	61 0 0	6l. p.sh.	132—136

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

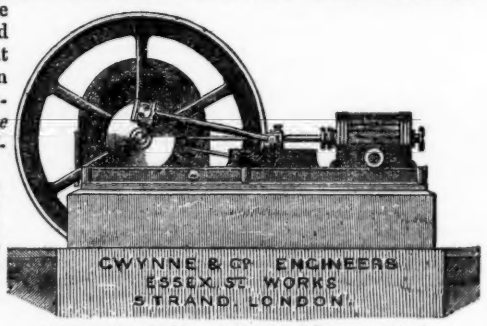
GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—*"Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship."*

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas without oscillation or variation in pressure. Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

☞ *G. & Co. are now making 6 Sets Exhausters and Engines for 105,000 cubic feet per hour, 3 Sets 180,000 Exhausters and Engines, with many others of all Sizes.*

NOTICE OF REMOVAL.

D. BRUCE PEEBLES & CO.

Beg to announce that they have REMOVED to their New Premises,

TAY WORKS, BONNINGTON, EDINBURGH,

To which all communications should now be addressed.

May 30, 1877.

J. & J. BRADDOCK,

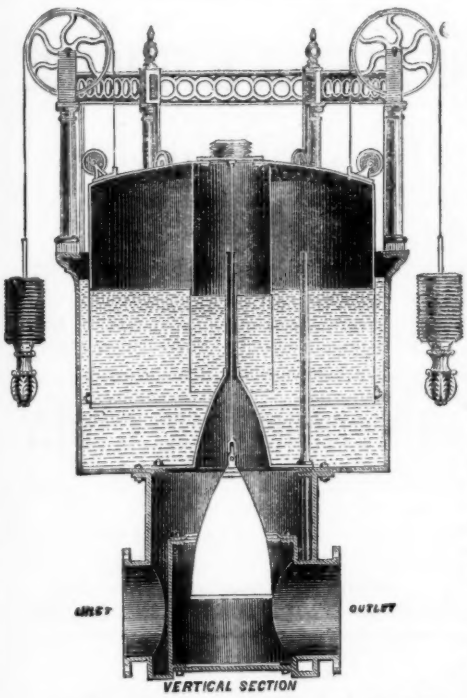
GLOBE METER-WORKS,

OLDHAM,

Beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

SAM. CUTLER & SONS,

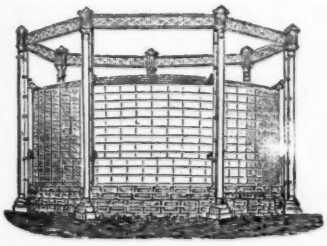
CONTRACTING GAS ENGINEERS,

GASHOLDER & GENERAL GAS APPARATUS MAKERS,

MANUFACTURERS OF

BOILERS, IRON ROOFING, IRON BRIDGES,

AND GENERAL IRONWORK.



S. C. AND SONS undertake Contracts of any magnitude for the **Erection of new and Remodelling of existing Gas-Works**, for **Gasholders, Cast and Wrought Iron Tanks, Iron Roofs**, and every description of **Apparatus** for the Manufacture and Distribution of Gas.

Special attention is invited to their **"Improved Condenser,"** which is very effective, and much approved; also to their patterns of **Annular** and other **Condensers, Scrubbers,** and **Purifiers,** of all sizes, which they arrange either with **Centre** or Ordinary **Slide Valves.**

WORKS FOR THE SUPPLY OF

VILLAGES, MANSIONS. FACTORIES, &c.

S. C. AND SONS undertake the **Supply** and **Laying** of **Mains** for **Gas and Water,** and supply all Castings, Connexions, and Fittings for Retort-House, Works generally, and for Streets. They also supply **Valves** of all descriptions, Iron and Clay Retorts, Hotpressed Retort-Lids, Steel Charging-Scoops of improved make, for which they have special machinery, Improved Coke and Coal Barrows, Cross-Bars and Screws, Bolts and Nuts, Furnace and Stoking Tools, Iron and Wood Purifier-Sieves, Lead, Yarn, Borings, &c., including every requisite whatsoever for a Gas-Work, a well-assorted stock being kept of those goods most in request.

SOLE MAKERS OF BRETT'S PATENT COKE BARROW.

Experienced Retort Setters sent to any part of the Kingdom.

Address: PROVIDENCE IRON-WORKS, MILLWALL, LONDON.

WANTED, the Address of Gas Officers who have not received a Copy of the New Edition of PAMPHLET for GAS COMPANIES to distribute to their Gas Consumers—"Cooking and Heating by Gas." A Copy will be sent free—extra Copies by post Threepence—direct from the Author, MAGNUS OHREN, Gas-Works, SYDENHAM, S.E.

GAS-WORKS SUB-MANAGER.

WANTED, by the Corporation of Walsall, a working SUB-MANAGER for the Walsall Gas-Works. Salary £200 a year. The appointment to be subject to three months notice on either side.

Applications, accompanied with not more than three testimonials, to be sent to the undersigned on or before Monday, the 13th of August. Each applicant to state how soon he could enter upon the duties.

Applicants canvassing the Members of the Corporation will be disqualified.

A statement of the duties and conditions of the appointment may be obtained on application to the undersigned.

SAML. WILKINSON, Town-Clerk.

Walsall, July 25, 1877.

REQUIRED, a competent Gas-Fitter and REPAIRER of METERS. None need apply whose character will not bear strict investigation. Wages 28s. per week, overtime paid.

Applications to be made by letter, addressed No. 391, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO GAS AND WATER ENGINEERS.

THE Birkenhead Improvement Com-missioners require the services of a Resident ENGINEER of their Gas and Water-Works. He must be thoroughly experienced in the manufacture and distribution of Gas, and also understand pumping manchinery and water distribution, and be competent to design and carry out additions to and extensions of both Gas and Water Works. Salary £400 per annum.

Applications (with recent testimonials), addressed to "The Chairman of the Gas and Water Committee, 50, Hamilton Square, Birkenhead," and endorsed "Engineer," to be sent in not later than Friday, the 17th of August next. Personal canvassing prohibited.

By order,

AMBROSE WALN, Clerk to the Commissioners.

Birkenhead, July 16, 1877.

GAS-LAMP INSPECTOR.

THE Vestry of the Parish of St. Leonard, Shoreditch, require the services of a competent person as LAMP INSPECTOR, to take charge of the Lamplighters, and superintend the Lighting, Cleaning, and Repair of Lamps, Meters, &c.; to read Meter Indices, and generally to perform all similar duties connected with the public lighting of the parish. No person will be eligible who has not had practical and mechanical experience in relation to gas supply and apparatus. He must produce testimonials of recent date from competent authorities to that effect, and be between 30 and 45 years of age. Salary £150 per annum.

Candidates must send in applications and testimonials not later than the 15th of August, addressed to me, and endorsed "Gas Lamp Inspector."

Such candidates as the Committee may desire to see personally will be written to.

By order,

E. WALKER, Vestry-Clerk.

Shoreditch Town-Hall, Old Street, London, E.C., July 30, 1877.

WANTED, a Second-hand Station-Meter, with or without, 6-in. connexions. Must be in perfect order, and to pass 2000 feet per hour.

Address No. 392, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

NEATH GAS-WORKS, SOUTH WALES.

WANTED, a Clerk and Collector at the above works. Salary £70 per annum, payable monthly. Month's notice.

Particulars of duties may be obtained of the Manager at the works.

Applications, in own handwriting, stating age, whether single or married, present and recent employments, and references as to character, to be sent to Town-Clerk's Office, Neath, endorsed "Application as Gas-Rents Collector, &c.," not later than Monday, the 13th of August inst.

The person appointed will be required to enter into a bond, with two approved sureties, in the sum of £200, for fidelity, faithful performance of duties, &c. Duties to commence forthwith on appointment.

By order,

ALFRED CURTIS, Town-Clerk.

Neath, Aug. 4, 1877.

WANTED, to Lease a Small Gas-Works, making from 2 to 6 millions per annum. Midland Counties, Stafford, Derby, or Leicester, preferred.

Address No. 393, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Advertiser, aged 35 years, a situation as WORKING MANAGER of a Gas-Works making from 6 to 10 millions. Fully conversant with the manufacture and distribution of gas, main and service laying, and meter fixing, and all the details of a Gas-Works. Good testimonials and references.

Address No. 394, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ELLAND-CUM-GREETLAND GAS COMPANY.

WANTED, a thoroughly qualified Man as METER INSPECTOR. A Man able to repair Meters (Wet and Dry) preferred. No one who is unable to produce first-class testimony of a recent date with regard to industry and sobriety need apply.

Applications, stating wages required, and accompanied with copies of two testimonials, to be sent immediately to Mr. W. A. WALKER, at the Gas-Works.

ELLAND-CUM-GREETLAND GAS COMPANY.

WANTED, a good Main and Service LAYER, a man able to take indices and fix meters will be preferred. He must also be a steady man.

Apply immediately, stating wages required and references to Mr. W. A. WALKER.

THE GASLIGHT & COKE COMPANY.

NOTICE is hereby given that a HALF-YEARLY ORDINARY GENERAL MEETING of the PROPRIETORS in this Company will be held at this Office, on FRIDAY, the 17th inst., at Twelve o'clock (noon) precisely, to transact the usual business, including the declaration of a Dividend for the half year ending the 30th day of June last.

By order,
JOHN ORWELL PHILLIPS, Secretary.
Chief Office, Horseferry Road, Westminster, S.W.,
Aug. 1, 1877.

TO GAS COMPANIES.

WE beg to call attention to our special STEATITE BURNERS for Street Lamps. Sample gross 8s. Quotations for quantities.

Messrs. TINDALL AND TELLING, Gas Apparatus Works, 74, Wynford Road, Penton Street, LONDON, N.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Brentford Gas Company are prepared to receive, on or before the 14th day of August next, TENDERS for the purchase of the surplus make of TAR at their Brentford and Southall Stations, in accordance with the particulars to be obtained by applying to FRANK MORRIS, Engineer to the Company, at the Works, High Street, OLD BRENTFORD.

By order.

TAR AND AMMONIACAL LIQUOR.

THE Directors of the Winchester Water and Gas Company are prepared to receive TENDERS for the purchase of the AMMONIACAL LIQUOR and surplus TAR produced at their Works for a period of One year, commencing on the 14th day of September next.

Particulars and forms of tender may be obtained on application.

Tenders to be sent in addressed to the Manager, and endorsed "Tender for Tar and Liquor," on or before Monday, the 3rd day of September.

CANTERBURY GAS AND WATER COMPANY.

FOR SALE, at the Gas-Works, eight Cast-Iron COLUMNS, Girders and top Carriages, removed from a 65 ft. by 20 ft. holder; good as new.

May be seen, or further particulars obtained, on application to the Manager.

Aug. 6, 1877.

GASHOLDER FOR SALE.

ONE Telescopic Gasholder, 70 feet by 20 feet, complete, with cast-iron tank, columns, girders, and inlet and outlet pipes, valves, &c., of modern construction. In first-class condition, and made by Messrs. Piggott and Co., of Birmingham.

To be seen at work at the Gas-Works, Birkenhead.

Cause of removal to make room for extensions.

To be sold a bargain, taken down, and re-erected ready for work.

For particulars, apply to Messrs. ASHMORE AND WHILE, STOCKTON-ON-TEES, or to view to Mr. CALLOW, Gas Engineer, BIRKENHEAD.

FOR SALE—One Exhauster by Jones, of Birmingham, capacity 25,000 feet per hour, with bye-pass, 12-in. inlet and outlet pipes and valves complete, in first-class working condition, price £40; also one Exhauster Regulator, with chain and weights complete, price £5.

Apply to CLAPHAM BROS., Ironfounders, &c., Keighley, YORKS.

NOTICE.

MESSRS. THOMAS DOCWRA & SON, Contractors, Balls Pond Road, hereby give notice that they have no business connexion with any other person of the same name.

BOUCK & CO., LIMITED,

TAR DISTILLERS & MANUFACTURING CHEMISTS,

MILES PLATTING, MANCHESTER.

BUYERS OF COAL TAR,
And Crude Products therefrom,
AMMONIACAL LIQUOR, &c.

WILSON'S
PATENT SAFETY PRESSURELESS
AUTOMATIC DIP-PIPES,
Fixed or moveable, adapted to works of any size, without other alteration than removal of existing Dips.

W. P. WILSON, 98, ASYLUM ROAD, S.E.

CLOTH GAS-BAGS FOR MAINS,

As supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather, India-Rubber, and Gutta-Percha Machine-Bands, Sheet and Washers, and Steam Joints.

T. BUGDEN, Manufacturer,
79, GOSWELL ROAD, LONDON, E.C.

CARLISLE CORPORATION GAS-WORKS.

THE Carlisle Gas Committee invite TENDERS for the supply of such COAL and CANNEL as may be required at their works in the City of Carlisle, for One year from the 1st day of September next.

Particulars may be had on application.

Tenders, endorsed "Tender for Coal," must be delivered to me on or before the 8th of August.

J. HEPWORTH, Manager.
Gas-Works, Carlisle, July 31, 1877.

FLEETWOOD GAS-WORKS.

THE Fleetwood Gas Company, Limited, invite TENDERS for the supply of about 1000 tons of GAS COAL, and 250 tons of CANNEL, to be delivered at Fleetwood Station, in such quantities and times as may be required during the Twelve months from Sept. 1, 1877, to Aug. 31, 1878.

Parties tendering must give full particulars of the Coal and Cannel offered, and the Colliery from which they propose to supply.

Tenders to be sent to the undersigned on or before the 20th day of August inst.

The Directors do not bind themselves to accept the lowest or any tender.

J. T. HALL.
Prescot, Aug. 1, 1877.

ROCHDALE CORPORATION.

THE Gas Committee of the Rochdale Corporation invite TENDERS for the supply of 60 yards of Turned and Bored GAS-MAINS, 30 in. diameter, coated with Dr. Smith's patent process, and delivered free at Rochdale Railway Station.

Particulars as to weights, &c., can be obtained from Mr. Paterson, Gas-Works.

Tenders, endorsed "Gas-Mains," to be sent to me on or before the 14th of August next.

By order,
ZACH. MELLOR, Town-Clerk.
Town-Hall, Rochdale, July 23, 1877.

TO IRONFOUNDERS.

THE Oldham Corporation Water-Works Committee are prepared to receive TENDERS for supplying about 900, 28-inch Cast-Iron SOCKET-PIPES; 650, 26-inch ditto, and a quantity of Branches, Bends, and other special Castings.

Particulars may be obtained on application to Mr. HERBERT ANDREW, Gas and Water Offices, Oldham.

Tenders to be sent in on or before Tuesday, Aug. 21.

By order,
H. BOOTH, Town Clerk.
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FOR THE YEAR 1877,

EDITED BY

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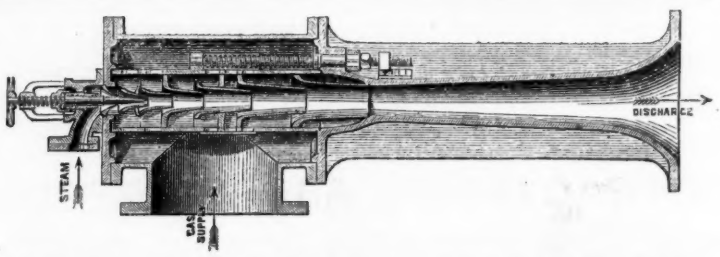

KÖRTING'S STEAM-JET GAS-EXHAUSTER.

IMPROVED CLELAND'S PATENT.

UPWARDS OF 250 IN USE.

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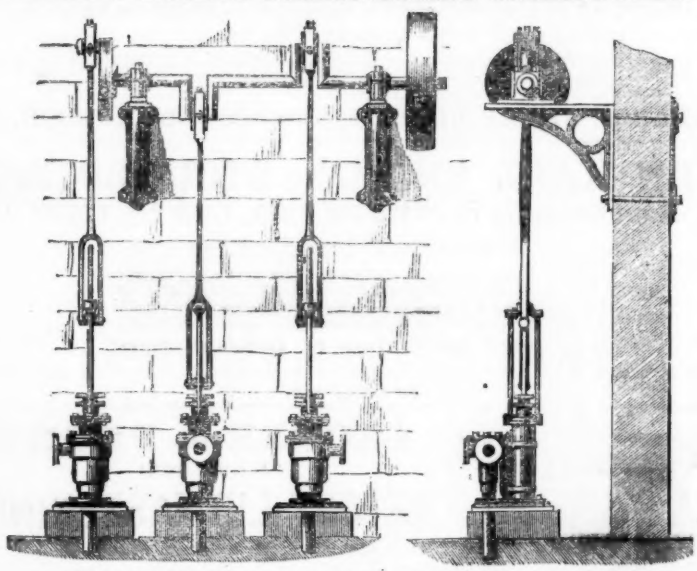

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For Water. For Tar. For Ammoniacal Liquor.

This illustration shows an arrangement of three (No. 179) Improved Double-Action Pumps driven from the same crank-shaft, as frequently supplied for use in Gas and Chemical Works. The suction and discharge pipes can be arranged for drawing from and delivering in any required direction.

These Pumps have been supplied to nearly all the large Gas Companies and Chemical Works, both for Pumping Water, Tar, and Ammoniacal Liquor.

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Application to be made to the MANUFACTURERS, the Horseley Company, Tipton, STAFFORDSHIRE.

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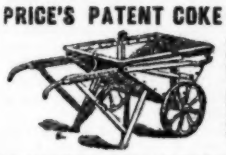

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J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

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DOUBLE-CLIP
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They have been sold to various Gas-Works throughout
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The undermentioned colours—ground in best linseed oil, and requiring only to be thinned down for use in the ordinary way—are kept in stock:—

Torbay Brown.	Torbay Red.
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Brixham Black.	Torbay Chocolate.
Light Blue.	Cream Colour.
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Imperial Stone.	Light Stone.
Bronze Green.	Salmon Colour.
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All other Colours made to order.

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A great variety of Colours ready mixed for the brush are also always kept in Stock, in 3 lb., 7 lb., 14 lb., and 28 lb. cans.

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And every Description of Gas Apparatus.

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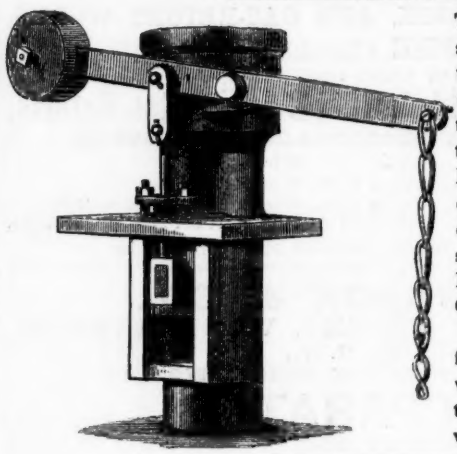

THE advantages of this Dip will be seen from the engraving. It is thoroughly effectual in its working, removing the whole of the pressure of the hydraulic main from the retort, thus causing a great saving in gas. It is very easy of manipulation, requiring little care and attention; it cannot get out of order, and, when shut, works as an ordinary Dip-Pipe. No accumulation of carbon in retort. Can be fixed to existing H-pipes.

In ordering the Dip, the distance from top side of hydraulic main to water-level should be stated; also the Dip at which it is required to work when the valve is shut.

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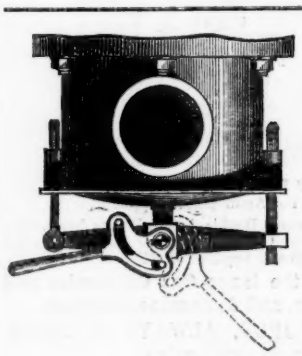

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PATENT
RETORT-LID FASTENINGS
Have now stood the test of experience, and have been found one of the greatest improvements in retort-house appliances yet invented. All who desire security and economy should give them a trial.

Prices and further particulars will be given on application to
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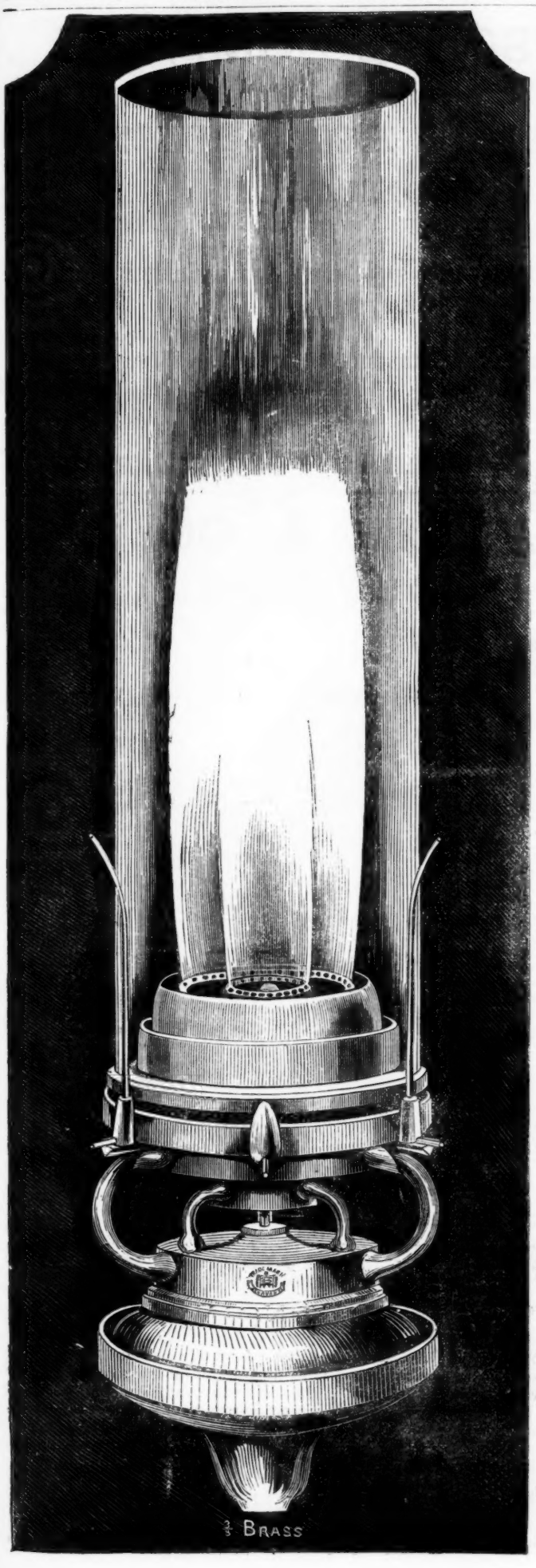
GAS-WORKS, STAFFORD.



PARIS, 1867.

LONDON, 1862.

WILLIAM SUGG,

GAS ENGINEER,

VINCENT WORKS, VINCENT ST.,

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PATENT

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NEW SIZE, No. N., DOUBLE FLAME,

With Self-Acting Governor.

LIGHT EQUAL TO 45 Parliamentary Sperm Candles of Six to the Pound.

Will burn any Quality of Gas from 12 to 50 candles, with

A VERY WHITE AND STEADY LIGHT.

Price 18s. each, with Chimney.

☞ **This Burner gives a greater amount of light per cubic foot of gas consumed than any other Burner yet produced.**

It can be used with Albatrine Shade, 20-in. diameter, for large Dining-Rooms or Halls; or with Large Silvered or Enamelled Reflector for Shops or Warehouses; or for Harbour and Signal Lights, Clock-Towers, &c.

The Sizes of the Patent "London" Argand Burner are now as follows:—

OLD SIZES: Nos. A, B, C, D, E, F, G, and H.
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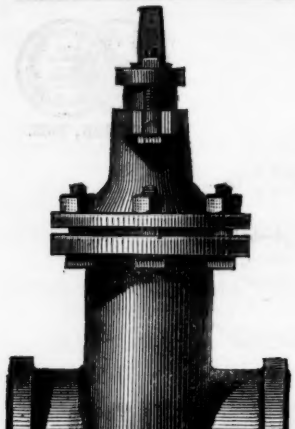

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All Sizes, Flange and Socket, kept in Stock, tested to 1000 foothead.

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SCREW-COCKS, HYDRANTS,
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And all other Machinery for
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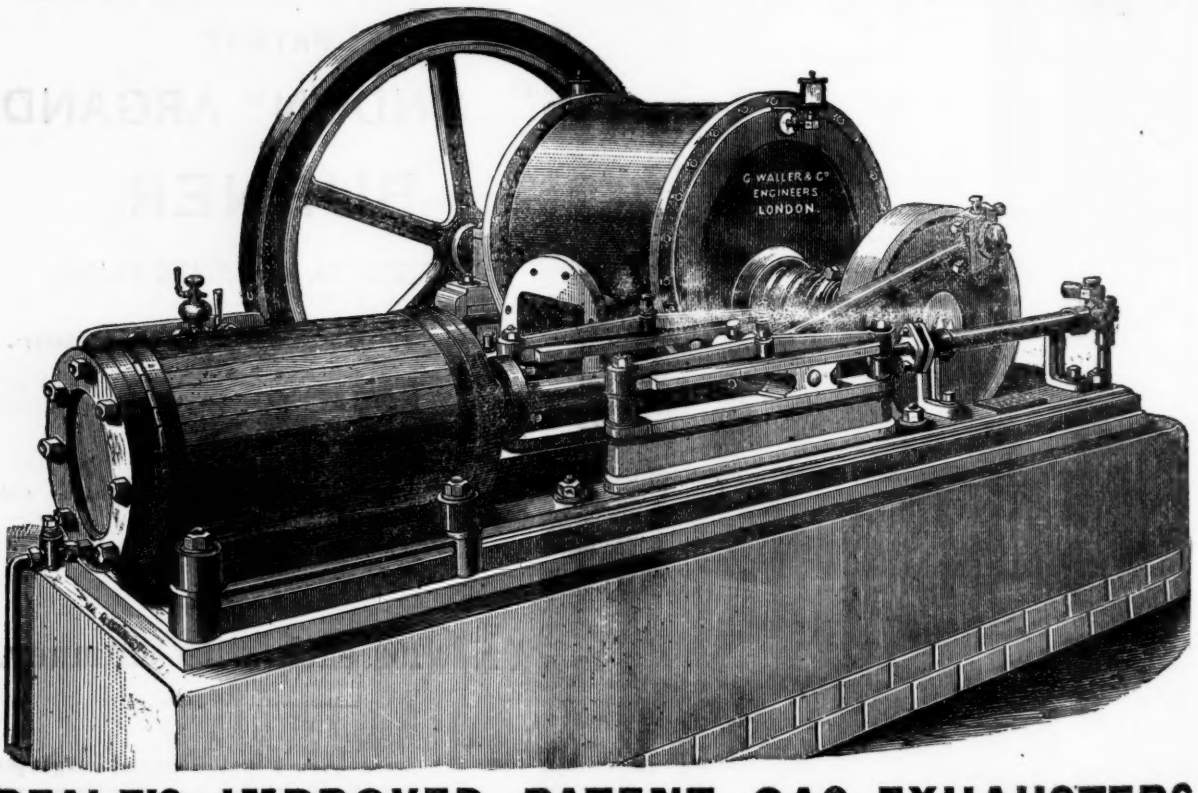
GEORGE WALLER & CO.,

GAS ENGINEERS AND CONTRACTORS.



BEALE'S IMPROVED PATENT GAS-EXHAUSTERS

AND

HORIZONTAL COMBINED ENGINES.

This arrangement, specially designed and manufactured solely by G. W. & Co., is suitable for works making 10,000 feet and upwards of gas per hour. The Exhausters are of full capacity for the quantity of gas to pass, have wrought-iron spindles to ensure perfect safety in working. The flanges of cylinders and edges of covers are turned. Inlet and outlet flanges turned, faced, and drilled, and the base of each Exhauster is planed. The Engines have wrought-iron connecting-rods, with solid gun-metal ends, steel piston and slide rods, turned and polished discs, heavy fly-wheels turned on rim and edge, and polished, cylinders are lagged with polished mahogany and brass bands, and the base-plates of these are also planed. A heavy bracket and plummer block, with strong gun-metal bearings, supports the shaft between the Exhauster and fly-wheel.

Disc Gas-Valves, Self-Acting Bye-Pass Valves, Hydraulic Main Valves, Pumps, &c., always kept in Stock.

Phœnix Engineering Works, Holland Street, Southwark, S.E.

THOMAS CARR & SON,
MANUFACTURERS OF
FIRE-BRICKS, LUMPS, TILES, RETORTS,
&c., &c.,
SCOTSWOOD FIRE-BRICK WORKS,
SCOTSWOOD-ON-TYNE.

HEBBURN MAIN GAS COALS.

T. Stone, Esq., of Weymouth, writes on Nov. 17, 1876: "I have used about 12,000 tons of this Coal, with, I think, the best possible results, although not always under the most favourable circumstances. My Coal account made up to Midsummer last showed a makeage of 10,524 cubic feet per ton of 14½-candle gas, and not a hundredweight of Cannel used. This statement would, I know, be incredible to many men, and may provoke the remark, 'How much of it is paid for?' For the gratification of such, I have to say that, of the above quantity, 9866 cubic feet per ton of Coal carbonized were brought to charge and duly paid for, with the exception of about 6s. per cent. for bad debts. The coke is of excellent quality. The above facts I hold to be a greater recommendation to your Coal than any words of mine could be."

THE TYNE COAL COMPANY, LIMITED, OWNERS.
W. RICHARDSON, Fitter,
29, QUAYSIDE, NEWCASTLE-ON-TYNE.

J. T. B. PORTER & CO.,
GAS ENGINEERS & MANUFACTURERS,
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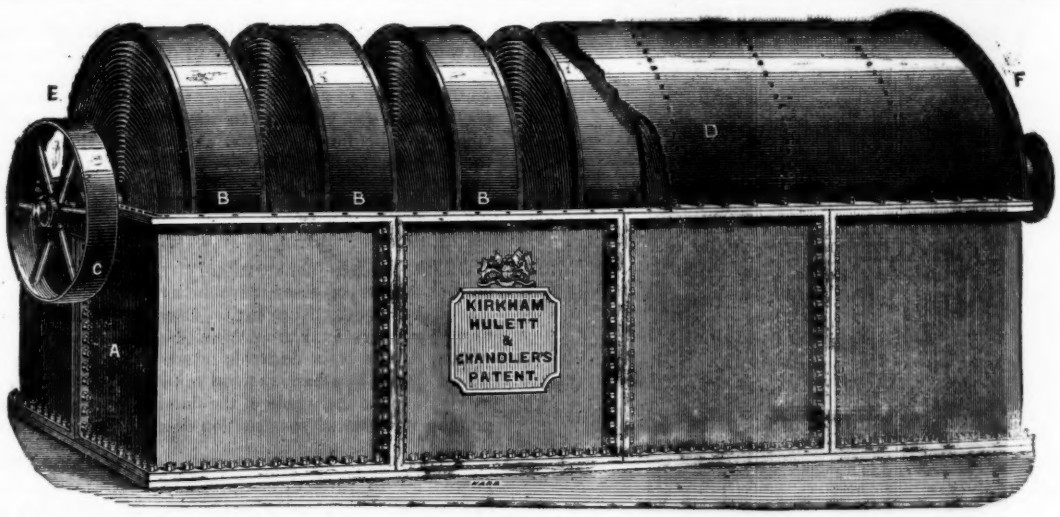
LINCOLN.

LONDON OFFICES: 1, WESTMINSTER CHAMBERS, S.W.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.
REFERENCES TO 500 WORKS ALREADY ERECTED.

N.B.—All Communications to be addressed to the FIRM ONLY.

STANDARD WASHER AND SCRUBBER.



The advantages of the Apparatus will doubtless be understood by those interested in gas manufacture.

The principal points of any Apparatus for the extraction of ammonia may be summarily stated as follows:—

1. **A large amount of Surface is desirable.**
2. **Such Surface should be always effectually Wetted.**
3. **The Surfaces or Scrubbing Material should cause no Pressure.**
4. **The Gas should meet various strength Liquors on its course.**
5. **However small the quantity of Water used, it ought to operate over the whole Surface.**
6. **Changing Scrubbing Material is both Objectionable and Expensive.**
7. **Economy both as to Space occupied and Cost of Apparatus is an important item.**

All these requisitions are supplied by the above Apparatus, of which the following is an explanation:—

A is a cast-iron tank, formed into several separate water-tight compartments.

B B B volutes of sheet iron fitted to the centre shaft, which is driven by the pulley, C, and causing the said volutes to revolve each in a separate compartment filled with water or other fluid.

D, the cover, has partitions fitted into it corresponding with those in the tank, sufficient space being left between the top of the partition in the tank and the lower edge of that in the cover, to allow the gas a free passage through the first volute to the second, and so on to the third, fourth, &c.

The action is as follows:—The crude gas entering at E is partly washed in the first compartment, which becomes 10 or 12 oz. liquor, or stronger if required, according to the quantity allowed to enter per ton; the gas then passes to the second, where the liquor is of a less strength; thence into a weaker liquor, as it passes from one compartment to the other, finishing at the last compartment or outlet, F, with clean water, which is constantly flowing and running over from one compartment to another, until it reaches the last space, from which it flows from the outlet-pipe into the well or tank ready for sale or removal.

Taps are inserted in each compartment for the convenience of drawing liquor for testing, &c.

Applications as to Cost, &c., may be obtained of either

Mr. D. HULETT, 55 & 56, HIGH HOLBORN;
Messrs. KIRKHAM & HERSEY, GAS ENGINEERS, 21, ABINGDON STREET, WESTMINSTER;
Or Messrs. CHANDLER, 104, NEWINGTON CAUSEWAY.

Inquirers will please state their Maximum Day Make.

C. & W. WALKER,
8, FINSBURY CIRCUS,
LONDON, E.C.

MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the important results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

They are, in all cases, constructed under guarantees to perfectly perform their work. They are now extensively used in the largest gas-works of London and the chief cities of Europe, the number in use exceeds **one hundred,** and their perfect efficiency and profit to a gas company have been fully established with every variety of coal used in Europe. References can be given to the largest gas-works in Europe.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

F. & C. OSLER,

45, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

ESTABLISHED 1807.

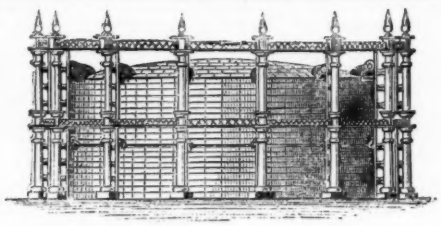
MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.

HOPE IRON WORKS,



STOCKTON ON TEES.

ASHMORE & WHILE,

GAS ENGINEERS & CONTRACTORS,

MANUFACTURERS OF GASHOLDERS,

GAS APPARATUS OF EVERY DESCRIPTION,

Including Improved

Retort-Lids, Boilers, Cast and Wrought Iron Tanks, Iron Roofing, Bridges, Girders,

And GENERAL IRONWORK.

N.B.—Estimates for all Gas Plant and Remodelling supplied on application.

LESMAHAGOW CANNEL COAL.

FERRAND DAVIES,

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SOLE AGENT FOR

THOMAS BARR'S LESMAHAGOW MAIN CANNEL.

Quotation and Analysis forwarded on application.

G. J. EVESON,

GAS COAL AND CANNEL FACTOR,

Has on offer, in quantities to suit purchasers, Best Wigan Arley Mine, Orrell Screened and Unscreened Gas Coal and Nuts; Best Yorkshire, Real Old Silkstone, Derbyshire, and North Staffordshire Screened and Unscreened Gas Coal and Nuts; also Best Lancashire, Yorkshire, Derbyshire, and other Cannel, as supplied to some of the principal Gas Companies in England, to whom references are permitted.

Analysis and Prices forwarded on application to

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N.B.—Gas Managers will oblige by advising when they will be prepared to receive Tenders.

STOURBRIDGE FIRE-BRICKS, RETORTS, CLAY, &c.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

173, ST. VINCENT STREET, GLASGOW.

SHOTT'S BOGHEAD.

LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL

Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full Analyses on application.

GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

SCOTCH CANNEL COALS.

The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES M'KELVIE,

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HAYMARKET, EDINBURGH.

Established 1840.

WILSON CARTER & PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station or export Best Wigan Arley Gas Coal and Nuts; best qualities of the Derbyshire, Yorkshire, and North Staffordshire Gas Coals and Nuts; also the best descriptions of Lancashire, Welsh, Scotch, and other Cannel.

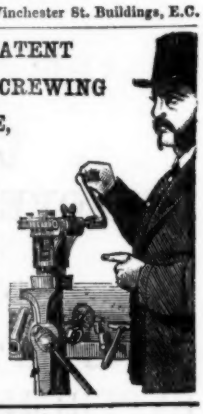
Messrs. WILSON CARTER & PEARSON, being contractors to several of the principal Gas Companies in the Midland Counties, have pleasure in being enabled to give them as references.

Chief Offices: Temple Buildings, 50, New Street, Birmingham.

London Offices: 6, Great Winchester St. Buildings, E.C.

GRIRDROD'S PATENT

PORTABLE PIPE SCREWING MACHINE,



For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great satisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

W. H. BAILEY & CO.,

Brassfounders, Gauge Injector and Tool Makers,

ALBION WORKS, SALFORD, LANCASHIRE.

ALBERT GAS COAL.

THE DERBYSHIRE

SILKSTONE COAL COMPANY,

LIMITED,

CAN OFFER A

GAS COAL

Of superior quality, delivered in trucks at any Railway Station in England, or shipped on board at Hull, Grimsby Docks, or Barrow-in-Furness.

Purified gas per ton of coal in cubic feet (average)	10,262
Illuminating power in candles	15·86
Weight of coke in lbs. per ton of coal	1,502

ANALYSIS AND PRICES ON APPLICATION TO

Mr. EDMUND TAYLOR, Secretary,

ALBERT COLLIERY, NEWBOLD, NEAR CHESTERFIELD.

THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

DODWORTH, BARNSLEY.

BENJAMIN WHITWORTH, Esq., M.P. . . . . Chairman.
Mr. RICHARD HARTLEY . . . . . Managing Director.

REAL OLD SILKSTONE GAS COAL.

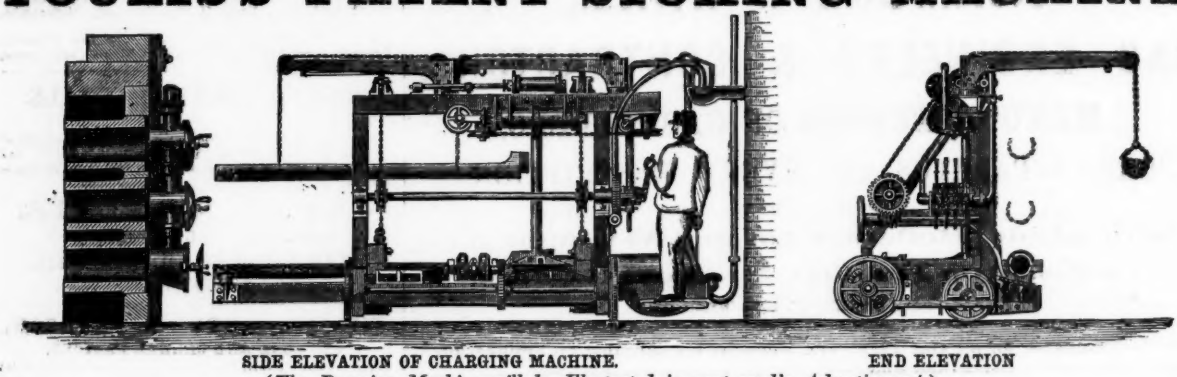
JAMES PATERSON, Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

FOULIS'S PATENT STOKING MACHINE.



SIDE ELEVATION OF CHARGING MACHINE. END ELEVATION

(The Drawing Machine will be Illustrated in next week's Advertisement.)

Makers: TANGYE BROTHERS and HOLMAN, London and Birmingham; ADAM WOODWARD and SON, Manchester; ROBERT LAIDLAW and SON, Glasgow; MASCHINENBAU-ACTIEN-GESELLSCHAFT HUMBOLDT, Kalk bei Deutz; Or all particulars may be had from JAMES WOTHERSPOON, 31, St. Vincent Place, Glasgow.

ALDER AND MACKAY,

GRANGE WORKS, EDINBURGH,

MANUFACTURERS OF

CONSUMERS IMPROVED GAS-METERS;

IMPROVED DRY GAS-METERS, in Cast-Iron and Tin Cases,

OF THE HIGHEST EXCELLENCE,

Warranted to measure correctly, and not to vary.

STATION METERS AND GOVERNORS,

EXPERIMENTAL METERS, PHOTOMETERS, GASHOLDERS, &c.

1862.

PATENT ANTIMONY PAINT.

MADE ONLY BY

GEORGE HALLETT & CO.,

296, ROTHERHITHE, LONDON, S.E.

CLASS II.

This Paint having been in general use over fifteen years (especially in some of the principal Gas-Works), and proved itself the best light-coloured Paint produced for resisting the influence of vitiated atmospheres, it is important that its qualities should be more widely known.

It is not discoloured like white lead in a sulphuretted atmosphere, nor washed off like white zinc; and its light colour reflecting heat, produces much less expansion of gas in holders painted with it than with dark colours, besides rendering them much more sightly. Its specific gravity is so much below white lead that the same weight will cover one-third more surface, while it is equal in body; and its price being about the same (30s. per cwt.), it is actually one-third cheaper. From experience, its manufacture is greatly improved, and it is quite suitable for all purposes in which white lead is employed.

The following Gas Companies in London have used the Paint for years—viz., The Gaslight and Coke, Imperial, Independent, City of London, Commercial, London, and Surrey Consumers.

N.B.—Antimony Paint, COVERING SO MUCH MORE WORK, costs about 20s. per cwt., as compared with White Lead at 30s. per cwt.; a similar economy arises from its use in Steam and Gas Joints, for which purpose it is superior to White Lead.

SPECIAL DRIERS FOR ANTIMONY PAINT SUPPLIED.

NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD.

CELEBRATED SILKSTONE GAS COALS.

The various descriptions of Gas Coal produced from the above Collieries possess an unequalled reputation, combining in a large degree the constituents essential for the production of the best quality of Coke and Gas of a high illuminating power.

A recent extensive development of the Collieries enables us to offer increased supplies.

JAS. PATERSON, Esq., of Warrington, after testing various qualities of our Coal, has sent the following testimony of their merits:—

Warrington Gaslight and Coke Company,
Offices, Mersey Street, Warrington, April 23, 1877.

Messrs. NEWTON, CHAMBERS, AND CO.,

Gentlemen,

After carefully testing the various samples of Gas Coals sent from your Collieries for analysis, I have pleasure in reporting them as belonging to the highest class of Gas and Coking Coals.

The average of Nine samples gives a yield of 12,500 cubic feet of 15½ Candle Gas, being equivalent to 664 lbs. of sperm per ton, and 1420 lbs. of fixed carbon of a very superior quality. All the samples bear a close relation to each other in value.

Yours truly,

JAMES PATERSON.

Full particulars will be sent on application to us—address as above.

CROLL'S
DRY GAS-METERS,

PRIZE MEDALS. (INVENTED & PATENTED IN 1844,) PRIZE MEDALS.

LONDON, 1851; NEW YORK, 1853 PARIS, 1855.

COMBINING ALL THE LATEST IMPROVEMENTS,

LONDON, 1862; DUBLIN, 1865; PARIS, 1867

MANUFACTURED ONLY BY

THE GAS-METER COMPANY, LIMITED,

238, KINGSLAND ROAD, LONDON, N.E.

Will be ready for Delivery in about Ten Days,

MR. A. VERNON HARCOURT'S COLOUR TESTS,

FOR BISULPHIDE OF CARBON, SULPHURETTED HYDROGEN, AND CARBONIC ACID IN COAL GAS.

The usual method by which the quantity of sulphur in coal gas is determined demands much time and considerable manipulative skill, as well as expensive apparatus. With Mr. Harcourt's Apparatus a test may be easily made by any intelligent person within a quarter of an hour, and the quantity of sulphur in any sample of gas ascertained within two or three grains per 100 cubic feet.

The Tests for Sulphuretted Hydrogen and for Carbonic Acid are equally simple.

THIS APPARATUS OUGHT TO BE POSSESSED BY EVERY GAS COMPANY.

Descriptive Particulars sent on receipt of 2d. in Stamps.

ALEXANDER WRIGHT & CO.,

GAS-METER AND APPARATUS MANUFACTURERS,

55, 55a, & 56, MILLBANK STREET, WESTMINSTER, LONDON, S.W.

F. W. HARTLEY, Manager.

R. LAIDLAW AND SON,

EDINBURGH AND **GLASGOW.**

Manufacturers of

CONSUMERS IMPROVED WET GAS-METERS,

THE UNVARYING WATER-LINE GAS-METERS,

IMPROVED DRY GAS-METERS, in Cast-Iron or Tin-Plate Cases;

STATION-METERS, ALL SIZES, up to 15 feet Square, with PLANED JOINTS;

Experimental Meters, Photometers, Pressure-Gauges, Governors, Test Holders, &c., &c.

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THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

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LIVERPOOL: Back Leeds Street.

SPECIAL NOTICE.—Our Patent Machine-made Retorts have now been in *actual work* nearly 1000 days, and are yet in good order. References on application.

July 2, 1877.

London: Printed by WILLIAM BOUGHTON KING (at the office of Clayton and Co. 17, Bouverie Street, Fleet Street); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Aug. 7, 1877.